SECTION 3
AFFECTED ENVIRONMENT

Baseline information for the RGCP was collected from field investigation during 2000/2001 and from the most current information sources. The information was used to determine current conditions of the RGCP to be affected or created by the river management alternatives. The following resource areas are used to describe baseline conditions:

1. Water resources
2. Flood control
3. Soils
4. Vegetation and wetlands
5. Wildlife habitat
6. Endangered and other special status wildlife species
7. Aquatic biota
8. Land use
9. Socioeconomic and environmental justice
10. Cultural resources
11. Air quality
12. Noise
13. Transportation

3.1 WATER RESOURCES

3.1.1 Water Consumption

Availability

Low precipitation conditions are prevalent in central New Mexico, severely restricting water availability in the RGCP. The semi-arid climate area receives an average of 8 to 9 inches of rain annually. Climatological data for Elephant Butte reservoir north of the RGCP, and Las Cruces, in the central area of the RGCP, are summarized in Table 3.1-1. Rainfall is heaviest July through September, and occurs mostly in intense thunderstorms. Long-term data for the Las Cruces area indicate that the average annual precipitation in the area is approximately 10 inches, most of which falls from May through September. Precipitation is in the form of brief, and often heavy, thunderstorms, which can cause local flooding and soil erosion from levee slopes and river banks (Bulloch and Neher 1980; NRCS 2003).

Table 3.1-1 Climatological Data for the North and Central Portions of the RGCP

	Elephant Butte Reservoir, Sierra County (1948-2002)*			Las Cruces, Doña Ana County New Mexico State University (1959-2002)*			
	Average	Daily Temperature		Average	Average	Daily Temperature	
Month	**Precip (in)**	**Max (°F)**	**Min (°F)**	**Precip (in)**	**Evapo (in)****	**Max (°F)**	**Min (°F)**
January	0.42	54.3	28.9	0.54	2.9	58.2	28.4
February	0.30	60.2	32.8	0.32	4.4	63.6	31.8
March	0.32	67.2	38.5	0.21	7.6	70.2	37.2
April	0.15	75.2	45.4	0.23	10.0	77.2	43.4
May	0.48	83.7	54.5	0.36	12.3	85.6	52.1
June	0.72	93.1	63.6	0.70	13.2	94.4	61.2
July	1.68	93.5	67.3	1.46	12.0	94.7	67.1
August	2.25	90.5	65.4	2.37	13.4	91.7	65.2
September	1.68	84.9	59.0	1.37	8.4	86.9	58.4
October	1.25	75.4	47.9	1.06	6.1	78.1	46.2
November	0.71	63.1	36.6	0.48	3.7	66.5	34.3
December	0.75	53.8	29.1	0.78	2.64	57.8	28.4
Annual	**10.71**	**74.6**	**47.4**	**9.89**	**93.7**	**77.1**	**46.2**

* NRCS 2003. [*ftp://ftp.wcc.nrcs.usda.gov/support/climate/wetlands/nm*]

** 1918-1965 data (Bulloch and Neher, 1980); Class A Pan-evaporation

The annual water release from Elephant Butte Dam averages 682,000 acre-feet. There is, however, a wide inter-annual variation in water availability. Since the operation of the RGCP, the region has experienced multi-year cycles illustrated by the water storage levels in Elephant Butte Reservoir (Figure 3-1). Based on the historical record, low storage conditions at the reservoir were prevalent for nearly 4 decades, until significant water storage levels were recorded during the mid 1980s and 1990s (NMOSE 2001). High rainfall precipitation over the past 2 decades, however, appears to be atypical based on the long-term rainfall record for New Mexico (Figure 3-2). The New Mexico Office of the State Engineer identified a trend toward drier conditions in recent years (NMOSE 2003).

Water storage in Elephant Butte Reservoir has experienced a sharp and steady decline as a result of severe drought conditions in the Upper Rio Grande Basin. The USBR (2003) reported a reservoir water storage of 147,300 ac-ft for September 15, 2003, the lowest level since December 1978. This storage level represents 7.5 percent of full reservoir conditions in Elephant Butte Reservoir. Seven of the eight years between 1996 and 2003 have been below average runoff due to poor snow pack conditions in the mountains of northern New Mexico and southern Colorado (USBR 2003).

Allocation

Water allocation is a key consideration for river management alternatives because flow regime modifications, riparian corridor development, and aquatic habitat diversification are likely to require water rights acquisition. All river water and agricultural return flows along the RGCP are fully allocated as part of the Rio Grande Project.

Figure 3-1 Historic Storage Levels in Elephant Butte Reservoir (NMOSE 2001)

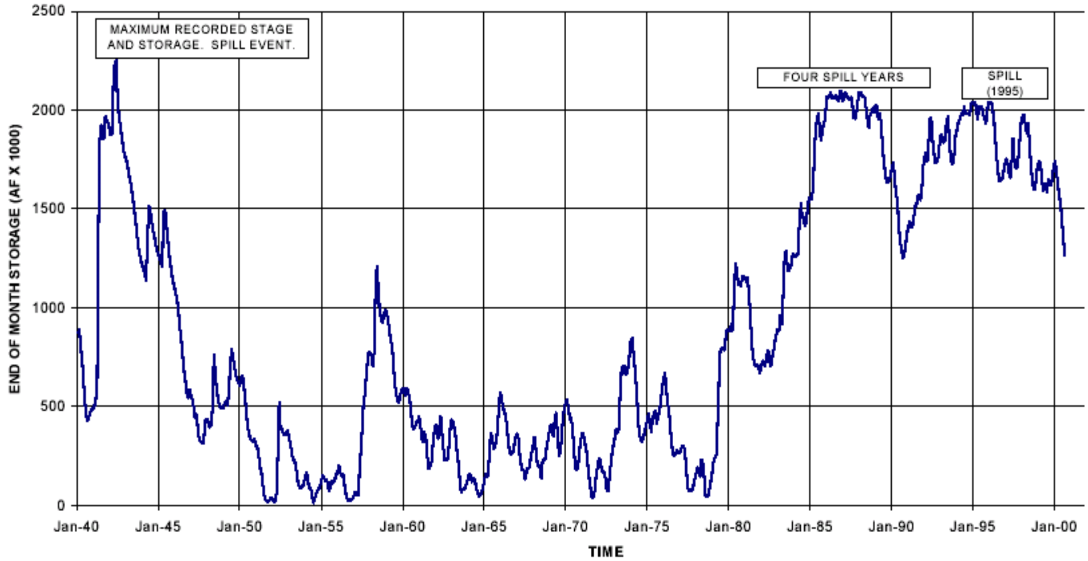


Figure 3-2 Long-Term Record of New Mexico Rainfall (NMOSE 2001)

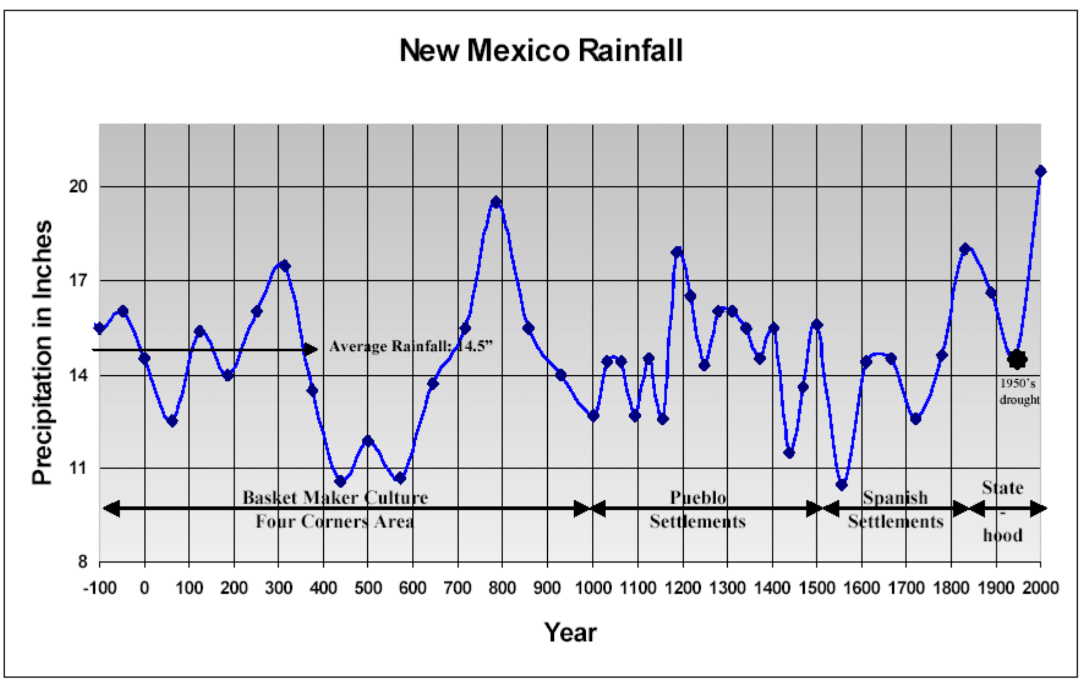


Figure 3-3 Flow Distribution Along the RGCP

Inflow / Outflow	Location	Average Flow (cfs) Mar-Oct	Nov-Feb	Annual
	Caballo Dam Release[b]	1,301	167	923
Percha Lateral/Arrey Canals (350 cfs)[a]	Water Diversion at Percha Dam	*(160)*	*(20)*	*(114)*
	Downstream Release[c]	1,141	147	809
Garfield, Hatch, Angostura and Rincon Drains	Return Flows[d]	78	16	58
	Seldon Canyon Flow[b]	1,219	163	867
Leasburg Canal (625 cfs)[a]	Water Diversion at Leasburg Dam[b]	*(265)*	*(13)*	*(181)*
	Downstream Release[c]	954	150	686
Seldon & Picacho Drains	Return Flows[e]	80	4	54
East and West Canals (950 cfs)[a]	Water Diversion at Mesilla Dam[b]	*(455)*	*(27)*	*(312)*
	Downstream Release[c]	579	127	428
Del Rio, La Mesa, Anthony, East, Montoya Drains, other	Return Flows[d]	196	97	163
	Upstream of Amer. Dam[b]	774	224	591
American Canal (1,200 cfs)[a]	Water Diversion at American Dam[b]	*(595)*	*0*	*(397)*
	Downstream Release[c]	179	224	194
Acequia Madre	Water Diversion at International Dam[b]	*(102)*	*0*	*(68)*

a. Maximum diversion capacities, in parenthesis, from U.S. Bureau of Reclamation (www.usbr.gov)

b. Highlighted values indicate stream flows. Values as reported in the Draft EIS, El Paso-Las Cruces Regional Sustainable Water Project (USIBWC & EPWU/PSB, 2000: Table 3.3-17).

c. Releases from dams were calculated as the difference between upstream flow and diverted flow.

d. Return flows were calculated as the difference between upstream and downstream flows.

e. Mesilla Valley return flows represent 30% of the diverted flow (USIBWC & EPWU/PSB, 2000, p. 3-10)

Rio Grande Project. This USBR project, in operation since 1905, furnishes irrigation water supply for about 178,000 acres of land in New Mexico and Texas, as well as electric power. The RGCP, that serves as a conveyance for water delivery to irrigated areas, is located entirely within the Rio Grande Project geographic coverage area. The Rio Grande Project is integral to implementing the Rio Grande Compact between the states of Colorado, New Mexico, and Texas. The compact was ratified by the states and approved by Congress in 1939.

Physical features of the Rio Grande Project include Elephant Butte and Caballo Dams, 457 miles of canals, and Percha, Leasburg, Mesilla, and American diversion dams. The Riverside Diversion Dam (approximately 15 miles south of of El Paso) was part of the original Rio Grande Project, but failed during a large flood event in 1987 [*www.usbr.gov/dataweb/html/riogrande.html*]. The Rio Grande Project has a maximum width of 6 miles and extends 200 miles from Elephant Butte Reservoir in Socorro County, through Sierra and Doña Ana Counties, New Mexico, and El Paso County, Texas. The irrigable lands are mostly contiguous, from 100 miles northwest to 40 miles southeast of the City of El Paso, with an area of 159,700 acres; 90,690 acres are in New Mexico and 69,010 acres are in Texas. The riverbed serves as the principal conveyance channel to all major diversions (Figure 3-3).

The Rio Grande Project water supply is provided through storage and regulated release of the waters of the Rio Grande, return flows to the river, wastewater flows into the river, and stormwater runoff. The Rio Grande drainage basin above Elephant Butte contains 25,923 square miles and has an average 79-year runoff of 904,900 acre-feet (ac-ft). The combined maximum storage possible for the two reservoirs is 2,396,520 ac-ft.

All Rio Grande Project lands in the State of New Mexico are included in the Elephant Butte Irrigation District (EBID), while all lands in the State of Texas are included in the El Paso County Water Improvement District No. 1 (EPCWID#1). The EBID receives approximately 53 percent, Mexico receives approximately 7 percent, and and EPCWID#1 receives 40 percent. Drainage water from EBID is included in the share received by EPCWID#1 (USBR 1982; USBR 1995).

The two irrigation districts have taken over operation of the Rio Grande Project canals, laterals, and drains, or any structures not on the river. The USBR, in conjunction with irrigation district personnel, operates the two storage dams and the diversions on the river, while the irrigation districts operate the rest of the Rio Grande Project facilities

Water Releases. The annual water release from Elephant Butte Dam averages 682,000 acre-feet. With normal yearly releases from Caballo Dam, coupled with return flows and rainfall runoff, water availability for agriculture is as follows:

- 494,979 ac-ft at EBID's headings in New Mexico;
- 376,862 ac-ft at EPCWID#1's headings in Texas, and
- 60,000 ac-ft at Mexico's Acequia Madre heading.

The original Rio Grande Project water allotment for irrigation district farmers was 3 ac-ft per acre per year (ft/yr). The water supply was allocated between the two irrigation districts based on the amount of land that each district had under irrigation.

The USBR regularly evaluates hydrologic parameters including reservoir storage, snow pack, and forecast precipitation to establish water allocation for the primary irrigation season. The allocation is set at the beginning of the primary irrigation season and (if less than a full allocation) is adjusted during the irrigation season based on updated information. Each irrigation district determines water allotment for lands within its boundaries (*www.usbr.gov/dataweb/html/riogrande.html*).

Since the beginning of the Rio Grande Project, some of the land originally under irrigation has been removed from agricultural use and is no longer irrigated. This has allowed additional water to be used on crops that require more than 3 ft/yr for adequate growth. Also, the Rio Grande Project water supply is not evenly distributed over a fixed number of acres. Farmers can fallow some fields to free up additional water for high use crops or lease their water to other farmers for their use. From 1979 through 1998 the average allotment for irrigated project lands in EPCWID#1 was 3.63 ft/yr (EPCWID#1 2000). In recent years, the allotment has been 4 ft/yr.

3.1.2 Water Delivery

RGCP Main Channel

The RGCP main channel was designed with a hydraulic capacity that ranges from 2,500 to 3,000 cfs in the Upper Rincon Valley, to less than 2,000 cfs in the Lower Mesilla and El Paso Valleys (Parsons 2001a).

Figure 3-3 is a schematic of the Rio Grande showing diversion and drain return points in the RGCP, and operational average flows during irrigation season, non-irrigation season, and for both seasons combined. Throughout the RGCP, drain flows that return to the river above American Diversion Dam are reused to supply demands lower in the system. The typical average flow ranges from 600 cfs to 1,100 cfs during the March to October irrigation season, and decreases to less than 200 cfs from November to February (Figure 3-3).

Caballo Dam discharges are initially diverted upstream of the RGCP, at Percha Dam. Water flow is subsequently rerouted for irrigation at three diversion dams that pre-date the RGCP: Leasburg Dam, Mesilla Dam, and American Diversion Dam. Most of the flow past American Diversion Dam is diverted south of the RGCP, at the International Dam, to meet United States-Mexico Treaty agreements. Along the RGCP the combined annual diversion is 645,000 ac-ft/yr based on average annual diversions of 181, 312 and 397 cfs at Leasburg, Mesilla Dam, and American Dam, respectively (Figure 3-3).

Diversion dams contain gate structures to route irrigation water from the RGCP to adjacent canals. Excess water overtops the dams and continues downstream. The canals leading from the diversion dams provide irrigation water to surrounding agricultural land through a network of canals and laterals.

Irrigation Distribution System

Water is removed from the agricultural land by a series of drainage canals and spillways that eventually flow back into the RGCP. The drains and spillways enter the ROW by passing through the flood protection levees. Some drains are equipped with gate valves or control structures at the levee crossing that which regulates water level in the drains. The gate valves and control structures are designed to be closed during a flood to prevent water from backing into the canal system and flooding land outside the levees.

In addition to the diversion dams and canals, there are six water-conveyance structures that cross the RGCP channel and ROW. Four siphons, the Rincon, Montoya, Hatch, and Garfield siphons, convey water from canals on one side of the river to the other. A fifth siphon, the Nemexas Drain, carries drainage water and runoff under the river to the drainage canal flowing through El Paso. The siphons were constructed to pass below the bed of the river. The sixth structure, the Picacho flume, consists of two elevated 42-inch diameter half pipes supported by concrete piers on top of timber piles that cross the floodway and channel to convey irrigation water from east to west.

Two of the siphons, Hatch and Rincon, are protected from erosion by boulder dams across the RGCP channel. New erosion protection structures have been constructed for both siphons. Siphon erosion protection structures provide a diversified aquatic habitat with backwater areas of low velocity water behind the dams, and white-water habitat created by water flowing over and down the energy dissipation structures.

Sediment Deposition

Tributary Basin. The total watershed area draining to the RGCP below Percha Dam is 823 square miles at Leasburg Dam, 875 square miles at Mesilla Dam, and 921.6 square miles at American Diversion Dam (USACE 1996). The upper watershed was characterized by USACE as a high-bed load sediment system associated with multiple steep arroyos (Type D4 in the Rosgen classification). In addition to contributing to channel flow, arroyos deposit sand, gravel, and boulders, providing a major constituent of the Rio Grande sediment budget. Between 1969 and 1975, the NRCS, at the request of the USIBWC, constructed sediment control dams at Broad Canyon, Crow Canyon, Green Arroyo, and Jaralosa Arroyo to decrease the sediment load into the river. In combination, these four tributaries drain over 300 square miles of the upper RGCP watershed. Additional sediment control dams and flood control dams have been built on smaller arroyos draining into the RGCP.

The 1996 USACE study also evaluated the sedimentation rate from tributary basins to the RGCP. Table 3.1-2 lists major arroyos, size of the drainage area, location of their confluence with the Rio Grande, and the presence of sediment control dams. The table gives the average annual computed total sediment load for major arroyos sorted by volume. The most significant sediment loads (greater than 5 ac-ft per year) are generated in the Rincon Valley, and are largely associated with tributary basins without control dams such as Rincon, Bignell, Placitas, and Montoya Arroyos; Tierra Blanca Creek; and Trujillo and Faulkner Canyons.

Table 3.1-2 Significant Sediment Loads Reaching the RGCP (USACE 1996)

Name	Drainage Area (sq. miles)	Confluence (miles above American Dam)	Average Annual Total Sediment Load (ac-ft)
Without Sediment Control Dam			
Rincon Arroyo	124.7	78.9	33.52
Tierra Blanca Creek	68.2	100.4	22.09
Trujillo Canyon	52.9	103.1	18.88
Bignell Arroyo	8.9	76.2	16.88
Placitas Arroyo	34.6	85.7	14.91
Sibley Arroyo	27.2	98.9	13.22
Faulkner Canyon	25	63.8	12.70
Montoya Arroyo	23	101.8	12.22
Foster Canyon	11	64.5	9.06
Reed Arroyo	9.6	78.5	8.64
Yeso Arroyo	9.5	94.9	8.60
Angostura Arroyo	8.9	80.2	8.41
Buckle Bar Canyon	2.12	67.6	5.41
With Sediment Control Dam			
Arroyo Cuervo	126.2	93.5	3.38
Berrenda Creek	87.4	97.4	2.60
Broad Canyon	68	67.6	2.20
Green Canyon	35.6	100.4	1.51
Nordstrom Arroyo	16.7	103.1	1.06
McLeod Arroyo	14.2	93.9	1.00
Box Canyon	8.7	49.8	0.83
Apache Canyon	7.8	49.8	0.80
Spring Canyon	7.4	80.2	0.79
Jaralosa Arroyo	6.8	95.2	0.77
Doña Ana Arroyo	6.9	51.2	0.77
Reed-Thurman Dam Drain	3.3	83.0	0.61
Ralph Arroyo	2.5	80.2	0.56

RGCP Channel. The main channel of the RGCP is maintained to remove debris and deposits, including sand bars, weeds, and brush growing along the bed and banks. Any major depositions or channel closures caused by sediment loads from arroyo flows are removed. The USIBWC also maintains the grade of the channel bed at the mouth of the arroyos to ensure the channel conveys irrigation deliveries. Sediment collected from channel excavation, arroyo mouth maintenance, and other sediment control efforts is deposited on the floodway, on upland spoil areas, or on other federal or private lands approved for this purpose.

The RGCP has largely retained its original configuration since its completion in 1943. Stream banks were routinely stabilized, primarily by riprap placement, until the mid-1970s when construction of NRCS flood control dams in tributary streams, in combination with upstream flow control, provided greater stability to the channel.

Because dams in tributary basins control runoff over one-third of the upper RGCP basin north of Leasburg Dam (USACE 1996), dredging of the main channel has been conducted infrequently over the last 30 years. A study on the scour and deposition of sediments within the main RGCP channel was conducted by the USACE (1996) as part of an evaluation of the RGCP functionality. The extent of bed elevation changes in the channel was evaluated for low, high, and 100-year flows. For the 100-year flood, changes ranged from a maximum deposit of 0.7 feet to maximum scour of 1.7 feet. For limited channel cross sections downstream from Rincon Arroyo, Trujillo Canyon, Tierra Blanca Canyon, Placitas Arroyo, and Faulkner Canyon, a more significant deposition (greater than 5 feet of sediment) was predicted. Relative to the 100-year storm, a more significant scour (maximum of 2.6 feet) and deposition (maximum of 1 foot) were estimated for a 10-year period of consecutive high flows, while 10 years of sustained low flow conditions would result in only minor scour and deposition along the RGCP (USACE 1996).

3.1.3 Water Quality

Water quality along the RGCP is defined by New Mexico and Texas on the basis of individual reaches for which designated uses have been defined. On a yearly basis both states submit to the USEPA a 303b surface water quality report in the degree to which those uses are being attained, and identify potential concerns in terms of water quality.

State of New Mexico. The RGCP segment in New Mexico is contained entirely by Assessment Unit NM-2102 that covers a 107-mile reach of the Rio Grande, from Percha Dam to the Texas border. The reach is subdivided into Unit NM-2101_00 from the Texas border to Leasburg Dam, and Unit NM-2101_10 from Leasburg Dam to Percha Dam. For the year 2002, the NMED reported that both reaches were fully supporting the following state-designated uses (NMED 2002, www.nmenv.nm.us/swqb/305b):

- Irrigation;
- Wildlife habitat;
- Limited warmwater fishery;
- Secondary contact; and
- Livestock watering.

State of Texas. The Texas reach of the RGCP is contained in Segment 2314 of the Rio Grande Basin. The 21-mile segment is located in El Paso County and covers from International Dam to the New Mexico State line. For 2002, the TCEQ reported that the following 5 designated uses:

- Aquatic life use;
- Contact recreation use;
- General use;
- Fish consumption use; and
- Public water supply use.

The state reported that these uses were fully supported with the exception of contact recreation use (TCEQ 2002). The standard was not met in 2002 due to bacterial levels above the designated use. Concerns were also indicated for algal growth and nutrient enrichment. (Table 3.1-3). Monitoring data for this determination was obtained from monitoring stations located in the Rio Grande confluence with Anthony Drain (Station 13276), and Rio Grande at Courchesne Bridge, 1.7 miles upstream from American Dam (Station 13272). A March 2000 to August 2002 summary of Rio Grande monitoring data for nutrients and suspended solids at El Paso (Station USGS 8364000) is presented in Table 3.1-4.

Table 3.1-3 Water Quality Concerns for Segment 2314 of the Rio Grande Basin (TCEQ 2002)

Assessment Area	Concern	Description of Concern
New Mexico State line to upstream of Anthony Drain	Algal growth	Excessive growth
Upstream of Anthony Drain to International Dam	Nutrient enrichment	Ammonia
Upstream of Anthony Drain to International Dam	Algal growth	Excessive growth

Source: TCEQ 2002

Table 3.1-4 Rio Grande Monitoring Data at El Paso from March 2000 to August 2002

Parameter	Number of Samples Reported*	Average Concentration (mg/L)	Lowest Concentration (mg/L)	Highest Concentration (mg/L)
Ammonia plus organic nitrogen, as N	20	0.349	0.22	1.1
Nitrite plus nitrate, as N	29	0.480	0.11	1.41
Nitrite, as N**	29	0.030*	<0.006	0.162
Phosphorus	20	0.069	0.008	0.171
Total suspended solids	29	481	34	2,350

* At monitoring station USGS 8364000.
** Nitrite values below the detection limit were not included in the average.

3.2 FLOOD CONTROL

3.2.1 Existing Flood Control

Levee System

The RGCP flood control system was constructed in conjunction with the canalization from 1938 to 1943. The system was designed to provide protection from a storm of large magnitude with a very low probability of occurrence, the 100-year storm.

The flood control levees extend for 57 miles along the west side of the RGCP and 74 miles on the east side, for a combined total of 131 miles. Naturally elevated bluffs and canyon walls contain flood flows along portions of the RGCP that do not have levees. The levees range in height from about 3 feet to about 18 feet and have slopes of about 3:1 (length to width) on the river side and 2.5:1 on the "land" side. The levees have a gravel maintenance road along the top.

The levees are positioned on average about 750 to 800 feet apart north of Mesilla Dam and 600 feet apart south of Mesilla Dam. The floodway between the levees is generally level or uniformly sloped toward the channel. The floodway contains mostly grasses, some shrubs, and widely scattered trees. The bank of the channel at the immediate edge of the floodway is typically vegetated with a narrow strip of brush and trees. Levees were originally built to provide 3 feet of freeboard during the design flood in most reaches.

Upstream Flood Control

Flood control in the RGCP relies on upstream flow regulation, as well as the use of levees, to contain high-magnitude flooding in areas with insufficient natural terrain elevation. In the RGCP flooding is largely controlled by upstream reservoirs that include Elephant Butte Dam, completed in 1916, and Caballo Dam, completed in 1938. Caballo Reservoir has storage capacity of 331,500 ac-ft (top of flood capacity), of which 100,000 ac-ft must be available during the months of July, August, and September for flood control (USIBWC 1994). During the non-irrigation season, that capacity is used for storage and regulation of winter flows.

In addition to flow regulation by Elephant Butte and Caballo Dam, flow regulation upstream of the RGCP is provided by a series of four reservoirs constructed under the Flood Control Act of 1941: Jemez Canyon Dam (1953), Abiquiu Dam (1963), Galisteo Dam (1970), and Cochiti Dam (1975). These dams have effectively controlled floods originating in the upper Rio Grande Basin (Winter *et al*. unpublished manuscript). Additional flood control is expected as a result of the Upper Rio Grande Water Operations Model (URGWOM), a multi-agency initiative to optimize water storage and delivery operations throughout the Rio Grande from Colorado to Texas. Improved flood routing through the RGCP is a component of the URGWOM simulation model [*www.spa.usace.army.mil/urgwom*].

3.2.2 Flood Containment Capacity Evaluation

In 1996 the Hydrology and Hydraulics Section of the USACE Albuquerque District completed an evaluation of potential flood containment capacity of the RGCP, the Rio Grande Canalization Improvement Program (USACE 1996). Hydrologic and hydraulic analyses of the 100-year flood were performed for the 105.4 miles of floodway between Percha Dam and American Diversion Dam. The study also included an evaluation of sedimentation in RGCP tributary basins, as well as a scour and deposition analysis. Findings of the Rio Grande Canalization Improvement Program are summarized in Appendix B.

Hydrologic Modeling

The USACE generated the 100-year flood discharges at selected locations along the Rio Grande using standard hydrologic procedures and the USACE program HEC-1.

The 100-year storm developed for the study area represented a summer thunderstorm rain flood, which generated the greatest peak flows in the study reach of the river. A storm centered below Caballo Dam was assumed. A 100-year 24-hour duration uniform rainfall of 2.39 inches and a NRCS Type IIa distribution were used. The USACE report provides detailed analysis of the methods used in generating the 100-year flood discharges.

Table 3.2-1, adopted from the USACE report, lists these peak discharges at the selected stations between Percha Diversion Dam and American Diversion Dam. Irrigation design flows, listed as reference values, represent the maximum capacity of the pilot channel (design value).

Hydraulic Modeling

The USACE generated the 100-year flood water surface elevations at selected locations along the Rio Grande using standard hydrologic procedures and the USACE computer program HEC-2. Modeling results, summarized in Table 3.2-2 identified various reaches of the RGCP with freeboard values potentially below the 3 feet design criteria, and in some reaches overtopping could occur or in unconfined areas the flood plain would extend past the ROW. The geographic distribution of potential deficiencies is shown in Figure 3-4 along with adjacent land use.

The most significant deficiency identified by the USACE study was located along eastern portion of Canutillo, Texas, only partly protected from flooding by a railroad embankment which acts as the east levee. While the railroad embankment extended for about 5 miles, the protection was discontinuous due to uncontrolled openings in the railroad embankment. To address this deficiency, the USACE (1996) recommended a structural solution that would involve both an earthen levee and concrete floodwall.

East levee at Canutillo. The proposed floodwall, beginning approximately at river mile 9.9 above American Dam and extending to river mile 11.3, is necessary due to the constricted flow area that exists; the levee-to-levee width in this reach is only 310 feet to 350 feet. This river section currently represents the hydraulic constriction in the RGCP reach where the levee-to-levee width cannot be reduced by the use of a new earthen levee

Table 3.2-1 Design Flows for Irrigation and 100-Year Flood

Miles Above American Dam	Irrigation Design Flow (cfs)	100-Year Flood Flow (cfs)
105.4	2,350	5,000
102.9	2,350	9,100
101.4	2,350	11,300
99.8	2,350	15,600
98.1	2,350	17,600
96.6	2,350	18,700
92.4	2,350	18,900
84.4	2,350	19,100
81.8	2,350	18,300
80.4	2,350	17,700
80.0	2,350	17,800
78.5	2,350	22,400
78.0	2,350	22,500
76.6	2,350	22,000
67.2	2,350	22,400
63.3	2,350	22,400
63.0	2,350	22,200
57.7	1,900	21,300
55.3	1,900	21,000
48.7	1,900	21,300
47.6	1,900	20,500
44.6	1,900	20,100

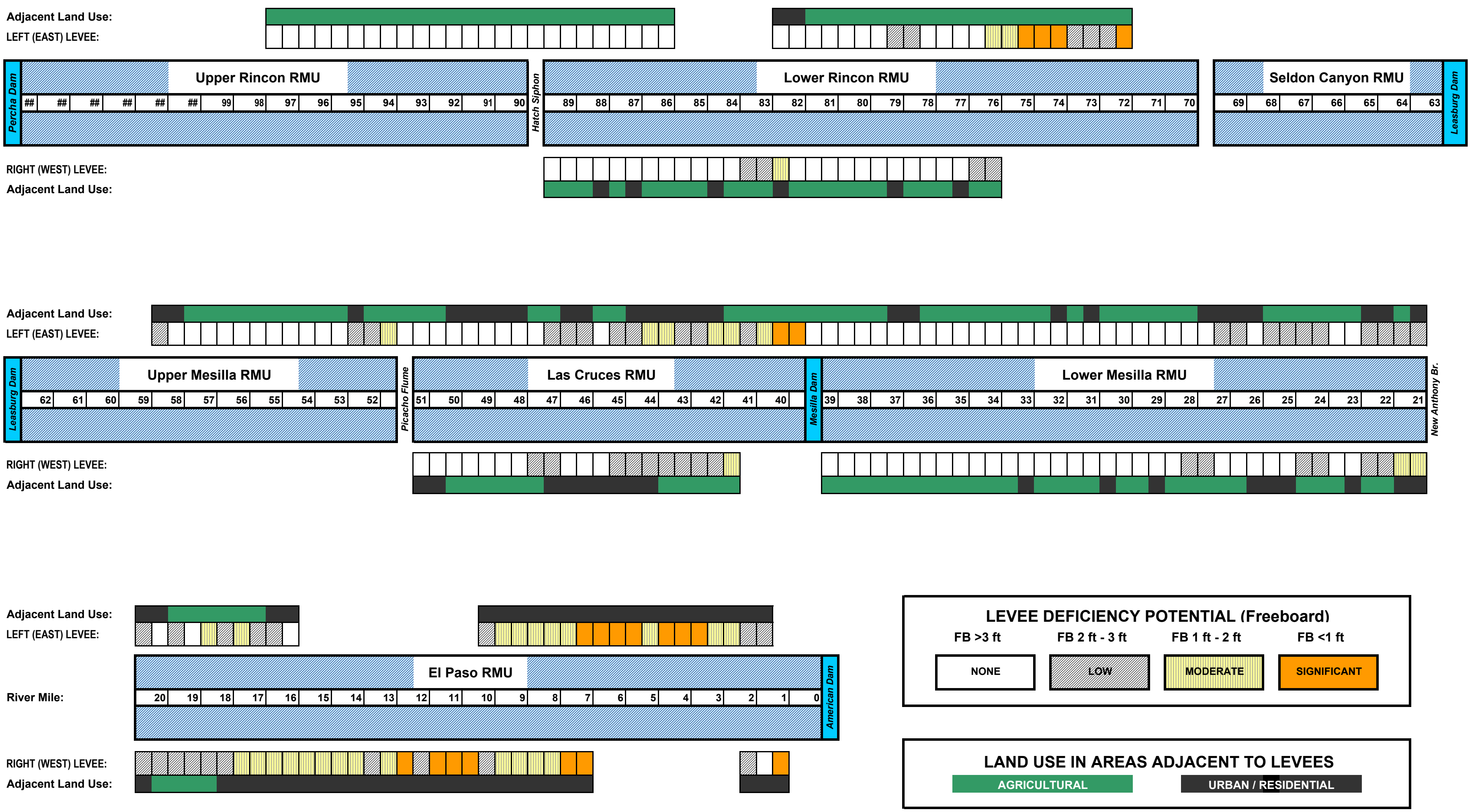
Miles Above American Dam	Irrigation Design Flow (cfs)	100-Year Flood Flow (cfs)
39.9	1,900	20,000
39.3	1,600	20,100
34.8	1,600	19,600
29.2	1,600	19,200
25.9	1,600	18,700
22.1	1,600	18,300
22.0	1,600	17,900
21.8	1,600	17,700
19.6	1,600	17,600
18.8	1,600	17,400
16.4	1,600	17,100
15.7	1,600	16,800
15.4	1,600	16,600
15.2	1,600	16,500
15.0	1,600	16,400
14.4	1,600	16,300
13.1	1,600	16,100
12.8	1,600	15,900
10.9	1,600	15,000
10.3	1,600	14,800
9.2	1,600	14,600
0.2	1,600	14,300

Table 3.2-2 Hydraulic Model Results for the 100-Year Flood Conditions

River Management Unit	Potential Deficiency (Combined length of right and left banks in miles)		
	No Freeboard*	Freeboard Less Than 1 foot	Freeboard Less Than 3 feet
Upper Rincon RMU	0.0	0.5	3.9
Lower Rincon RMU	1.7	1.7	4.7
Seldon Canyon RMU	2.6	0.2	1.3
Upper Mesilla RMU	1.2	0.9	3.4
Las Cruces RMU	0.0	0.0	3.5
Lower Mesilla RMU	1.3	0.6	15.4
El Paso RMU	6.4	2.8	22.1
Total Length	*13.2*	*6.7*	*54.3*

*Levee potentially overtopped or water surface extending beyond right-of-way

Figure 3-4 RGCP Characterization in Terms of Potential Levee Deficiencies and Adjacent Land Use



DEIS in-text Figures.xls\Figure 3-4 - 12/15/2003 section without adversely increasing the water surface elevation upstream. The recommended 7,500-foot-long floodwall would vary in height from 8 to 10 feet, without freeboard, and the structure would be located riverside and immediately adjacent to the existing east river levee provided by the railroad embankment. To accommodate local drainage, the flood wall must tie into the drainage control structures at appropriate locations. Downstream of river mile 10.8 and upstream of river mile 12.2, the levee-to-levee width expands to approximately 500 feet, allowing the floodwall to transition to an earthen levee.

West levee at Canutillo. The west-side levee would incorporate a flood wall extension for the same constricted area (river mile 10.8 to river mile 12.2) to contain the increased water surface elevation resulting from the decrease in effective flow area with the east-side flood wall in place. The west-side flood wall would consist of a vertical wall partially embedded in the existing levee crown. A floodwall extension is possible on the west side because, unlike the east-side levee, the west-side levee does not serve the dual propose of railroad embankment and flood control levee. The existing levee section should be checked for through seepage and underseepage and for embankment and foundation stability. Some methods of controlling seepage and improving embankment stability could eliminate the economic advantage of the flood wall in comparison to an earthen levee enlargement.

Other Recommendations. The flood containment capacity study (USACE 1996) also recommended inspections of levee closure devices to ensure they would operate correctly in case of flood emergencies, and replacement of five bridges (Brickplant, Courchesne, Borderland, Canutillo, and Tonuco) in which the 100-year flood could overtop the roadway elevation.

3.3 SOILS

Intermontane sediments known locally as bolson deposits underlie most of the RGCP. These sediments washed down from nearby mountains and filled the basin that formed during the Rocky Mountain Orogeny and faulting that occurred in the Tertiary period, continuing through the Quaternary. The basin in El Paso County, known as the Hueco Bolson, was initially enclosed, but as the Rio Grande channel meandered through the area, the basin was drained. Since then, water action has leached carbonates from the parent material and formed layers of caliche at various depths below the surface (USDA 1971).

3.3.1 Soil Characterization

Soils on the Rio Grande floodplain formed in alluvium recently deposited by the river. At the landscape level, the NRCS characterizes these floodplain soils as the Glendale-Harkey map unit and the Glendale-Gila-Brazito map unit (USDA 1980).

Glendale-Harkey Map Unit: soils are deep, well drained, and formed in alluvium. This map unit is composed of Glendale soils (21 percent), Harkey soils (19 percent), Brazito soils (10 percent), Adelino, Agua, Anapra, Anthony, Armijo, Belen, Vinton, Agua Variant, Belen Variant, and Vinton Variant make up the remainder of the map unit. Slope within this map unit typically range from 0 –1 percent. Surface soils are typically silty clay loams over stratified layers of loamy soils and fine sand. Locally, the RGCP soils are classified as Made land, Gila soil material. This series consists of soil materials, chiefly from Gila soils, which are silty clay loam, fine sandy loam, and sand in texture. The soil is made of recently deposited alluvial material, which has been moved and shaped for construction of levees and for relocation and straightening of the river channel.

Glendale-Gila-Brazito Map Unit: soils are deep, nearly level to gently sloping. Slopes range from 0 to 5 percent. Formed in mixed alluvium, these soils are found along the Rio Grande in Sierra County. Typically, the surface layer is a fine loamy sand or clay loam, and extends to a depth of 2 feet. The many arroyos that cut through the area are a source for sedimentation.

Along the perimeter of the floodplain, soils are typically formed in alluvium, alluvium modified by wind, and eolian material. The NRCS characterize these soils as the following three map units: Nickel-Bluepoint, Bluepoint, Caliza-Bluepoint-Yturbide, and Nickel-Upton (USDA 1980). Upland soils are calcareous and with a potentially low availability of phosphorus, iron, copper, zinc and manganese. Salinity is related to permeability and irrigation practices, but in general is much lower than in the clayey soils along the valley (USIBWC & EPWU/PSB 2000).

Nickel-Bluepoint Map Unit: soils are well drained, nearly level to extreme sloping. Slopes may range from 1 to 75 percent. These soils are found on alluvial fans, terraces, and piedmonts, and are formed in mixed alluvium modified by wind action. This map unit exhibits some characteristics of badlands, where extreme erosion is evident.

Bluepoint Map Unit: soils are deep, gently undulating to moderately rolling along the Rio Grande and associated tributaries. Slopes range from 1 to 15 percent. Typically, the surface layer is a fine, loamy sand, overlying a loamy fine sand. The many arroyos that cut through the area are a source for sedimentation.

Caliza-Bluepoint-Yturbide Map Unit: soils are deep, gently undulating to very steep, and are found on ridges and terraces. Slopes range from 1 to 40 percent. The Caliza soils that compose 24 percent of this map unit are typically a very gravelly sandy loam. The Bluepoint soils are typically a loamy sand at the surface, overlying a loamy fine sand. The Yturbide soils are found on side and terminal fans of arroyos and river deposits, and are typically a loamy sand overlying gravels and sands.

The Nickel-Upton Map Unit: composed of undulating to moderately rolling soils on fans, terraces, ridges, and piedmonts. Slopes range from 3 to 15 percent. The Nickel soils are deep and well drained, and are formed in gravelly alluvium on terraces. Typically, the surface layer is a gravelly fine sandy loam. The Upton soils are shallow and well drained. They formed in gravelly alluvium and are on piedmont slopes and ridges. Typically, the surface layer is a gravelly sandy loam, overlying indurated caliche.

3.3.2 Soil Distribution within the RGCP

Table 3.3-1 presents the distribution of soils along the RGCP by RMU, indicating acreage associated with each type of soil. Values were obtained by superposition of the ROW and geographic soil distribution obtained from New Mexico Resource Geographic Information System (GIS).

Table 3.3-1 Soil Distribution Along the RGCP

RMU	Map Unit	Percent Within RMU
Upper Rincon	Glendale-Gila-Brazito	33.5%
	Glendale-Harkey	28.8%
	Nickel-Upton (uplands)	10.3%
	Nickel-Bluepoint (uplands)	13.6%
	Caliza-Bluepoint-Yturbide (uplands)	13.8%
Lower Rincon	Glendale-Harkey	95.1%
	Caliza-Bluepoint-Yturbide (uplands)	2.8%
	Nickel-Bluepoint	1.2%
	Bluepoint	1.0%
Upper Mesilla	Glendale-Harkey	57.1%
	Bluepoint	20.5%
	Nickel-Upton	22.4%
Las Cruces	Glendale-Harkey	100%
Lower Mesilla	Glendale-Harkey	82.8%
	Bluepoint	17.2%
El Paso	Glendale-Harkey	90.5%
	Bluepoint	9.5%

3.3.3 Soil Erosion

Soil erosion is a function of plant cover, grade and length of slope, management practices, and climate. High grazing intensity (high numbers of stock over a long period of time) can alter plant species composition (Chaney *et al*., 1990), can affect soil infiltration rates, and can increase soil erosion (Platts 1989). Soil erosion occurs in the highly sloped uplands as well as the floodway (riparian zone). Uplands soils typically have higher soil erodibility factors and lower soil-loss tolerance factors than floodplain soils. This is due in part to the higher slope grades that are exhibited by upland soils, as well as land cover characteristics.

Uplands

Soil erosion is influenced primarily by soil cover. Cover intercepts precipitation, reducing raindrop impact, restricting overland flow resulting in less runoff and erosion

Research indicates that cover value between 30-40 percent are needed to control sheet and rill erosion (BLM 1994). Sufficient cover requires adequate vegetation basel cover foliar cover and natural litter (BLM 2000). Estimated annual soil loss of RGCP uplands is presented in Table 3.3-2.

Table 3.3-2 Potential Sediment Load from Upland Erosion

	Watershed Size (sq. miles)	Sediment Load of watershed (ac-ft/yr)	Estimated Percent Vegetative Cover	Amount of Uplands within the RGCP (acres)	Potential Load Generated in RGCP Uplands (ac-ft/yr)
UPPER RINCON RMU					
Berrenda Creek	87.4	2.60	15%	530	0.02
Miscellaneous Area 3 (Yeso Arroyo)	9.5	8.60	15%	40	0.06
Arroyo Cuervo	126.2	3.38	13%	850	0.04
Miscellaneous Area 4a*			13%	220	0.31
LOWER RINCON RMU					
Angustora Arroyo	8.9	8.41	18%	100	0.15
Reed Arroyo	9.6	8.64	18%	40	0.06
Miscellaneous Area 6 (Bignell Arroyo)	8.9	16.88	14%	25	0.07
Total				*1805*	*0.71*

* Values estimated using adjacent arroyo cover values and soil classification

Riparian

Grazing in riparian areas may have long-lasting, often irreversible effects on riparian areas. Overgrazing of riparian areas can result in erosion due to hoof action and reduced vegetative cover. In addition, overgrazing in riparian areas can lead to a decline in aquatic habitat by reducing or eliminating the number of bank undercuts and cause a decline in water quality due to increased turbidity and fecal contamination (Platts 1989). During field surveys, cattle were observed grazing along the banks and in the river at several locations.

Riparian areas have higher quality forage (higher proportion of green to dead plant material and a higher proportion of leaves to stems), and greater amounts of water and shade (Briggs 1996). Vegetation surveys conducted by Parsons (2001), indicated that grazed areas appeared to be overgrazed and varied from very little vegetative cover (0 on a scale of 5) to good coverage (3 on a scale of 5). The amount of sediment entering the river as a result of hoof- action and reduced vegetative cover are unknown. However, the below-average to poor wildlife quality (discussed further in section 3.4) is indicative of reduced vegetative cover and increased soil erosion potential.

3.4 VEGETATION AND WETLANDS

This section describes the vegetation communities within the RGCP. It includes a definition of riparian communities, vegetation community classification, background information on invasive species that dominate the RGCP, and a discussion of regeneration strategies of native and invasive species. A more detailed discussion of the current environmental conditions can be found in previously published technical reports (Parsons 2000a, 2001b, 2001c).

3.4.1 Ecological Region

The Chihuahuan Desert can be subdivided into three regions, the northern Trans-Pecos region, the middle Mapimian region, and the southern Saladan region (MacMahon 1988). The RGCP is included in the northern Trans-Pecos region of the Chihuahuan Desert. This region includes all sections of the Chihuahuan Desert in the U.S. and the northernmost sections of the desert of Mexico.

The Trans-Pecos region of the Chihuahuan Desert is a mosaic of grasslands and desert shrublands (Burgess 1995, MacMahon 1988, McClaran 1995) with grassland dominated by Tobosa and black grama. The desert shrub species are typically creosote bush or tarbush with other shrub species and succulents present. Vegetation along the Rio Grande and streams is dominated by willows, cottonwood, and mesquites. Other species such as ash and desert willow are often present.

Historically, the vegetation along the Rio Grande was composed of cottonwoods and willows, with Berlandier ash, netleaf hackberry, and little walnut. Fossil evidence traces this community back 2 million years. The Rio Grande vegetation communities were dynamic, growing, and spreading when weather was favorable, and dying off during periods of prolonged drought or prolonged floods. A wide range of age classifications, from old growth to pioneer communities, provided a varied and diverse habitat (Crawford *et al*., 1996).

The current dominance of invasive vegetation such as salt cedar and subsequent decline of species characteristic of historic bosques is in response to anthropomorphic factors including altered hydrology and landuse changes among others (Everitt 1998; DeBano and Schmidt 1989; Schmidly and Ditton 1978).

3.4.2 Riparian Communities

Riparian Community Characterization

Riparian is generally defined as land occurring along a water body transitioning between permanently saturated wetlands and upland areas (BLM 1993, Briggs 1996). Older and more classical riparian interpretations identify primarily woody vegetation associated only with stream or river systems. Recent interpretations include a broader view involving, surface and subsurface water influences, and natural forces and human-induced activities that affect woody and emergent vegetation (Dall *et al.,* 1997). For classification purposes, lands within the floodway (including wetlands) are classified as riparian.

Riparian areas are often more productive then surrounding lands due to the availability of water and nutrients. Vegetation is generally taller and denser, providing a food base and cover for wildlife. Riparian areas provide numerous environmental functions, including the following (Briggs 1996):

- Riparian areas can serve as transition zones between two very different ecosystems, e.g., desert scrub and aquatic. Density and diversity of wildlife and plant species are higher in this ecotone.
- Riparian vegetation provides bank stabilization and moderates water temperature (e.g., by shading).
- Riparian areas serve as major corridors for wildlife movement
- Riparian areas, like wetlands, provide groundwater recharge and flood hazard reduction and nutrient sinks.

The functioning condition of a riparian system is a result of the interaction of geology, soils, water, and vegetation. Research indicates that water exchange through periodic or seasonal inundation strongly influences riparian functional properties (Gregory *et al*., 1991). The effect of regulated river flows and the subsequent long-term effects on riparian function is not fully known, however, recent studies suggest that periodic flooding is required for establishment and maintenance of native vegetation communities (Molles *et al.,* 1998, Crawford *et al.,* 1996). Cottonwood and willow trees disperse seeds from about May 25 to June 20, peaking in early June (U.S. Department of Interior, Bureau of Reclamation 2000). Freshly deposited or reworked alluvium is required to provide substrate for seedling establishment (Auble and Scott 1998). This alluvium is generally produced by scour of the riverbank during floods.

A "healthy" riparian system normally exhibits an active floodplain with diverse channel characteristics providing varied aquatic habitat for fish production, waterfowl breeding, and other wildlife uses. These channel characteristics are formed by periodic flooding and high velocity flows, which may be accompanied by some erosion, bank scouring, and local loss of vegetation. Healthy riparian systems are characterized by an interaction between the aquatic and riparian zone (Molles *et al*., 1998).

Riparian Communities Within the RGCP

There has been limited research conducted about the riparian communities in the RGCP (Watts 1998). To develop baseline information for the RGCP, field studies documenting vegetation and habitat quality were conducted by Parsons (2001).

Field studies showed that periodic mowing maintains a large portion of the riparian community in disturbed, or early seral state characterized by herbaceous vegetation and shrubland re-growth. Riparian areas not mowed or otherwise maintained, can rapidly become dominated by non- native salt cedar. The control of woody vegetation through mowing is a major O&M activity within the floodway and is conducted to reduce woody vegetation for flood control and water delivery purposes.

The floristic composition of riparian vegetation is related to river proximity. A border of hydrophytic vegetation, generally 10 to 15 feet wide, occurs on the riverbank forming the sloped side of the channel. This narrow woody zone is dominated by salt cedar with occasional seep willow, willow, or herbaceous vegetation, including common reed, sedges, and rushes. Isolated wetlands are found along the river channel, spillways, and low-lying areas within the floodplain. Salt grass is the common grass occurring in wetland sites. Riparian vegetation is for the most part disconnected from surface water sources.

The majority of the RGCP floodway is rarely flooded and disassociated from the river channel. Natural channel characteristics formed through periodic flooding and high velocity flows are largely absent. The widespread absence of young and mid-aged cottonwood within the RGCP (Parsons 2001a) suggests that the irrigation driven hydrologic regime has greatly influenced riparian native species composition.

In terms of native cottonwood regeneration, there is little evidence of new seedling establishment among the scattered and declining cottonwood remnants. Natural propagation appears to be limited to isolated, new growth trees propagated through root suckers with little successful seed germination observed (Parsons 2001a).

Hydrologic Connectivity of Riparian Communities

Riparian communities can be categorized as connected or disconnected based on their hydrologic connectivity to the river (Crawford *et al*., 1996). Disconnected communities are isolated from the river influence and rarely inundated by overbank flows. The vast majority of the RGCP is considered disconnected from the river. In contrast, connected communities are influenced by the river through periodic inundation, flushing and potential scouring. Connected communities often exhibit a forest floor covered by few leaves and debris, and large well separated trees with dense canopy. Periodic inundation and flushing removes leaf litter and create moist soil conditions suitable for seed regeneration. Connected communities have highly productive soil and have more rapid biochemical cycling then disconnected communities (Crawford *et al.,* 1996).

Identification of hydrological connected areas was conducted to determine the location of potential riparian restoration projects (Parsons 2003a). The hydrologic floodplain was defined as areas inundated from the highest average monthly flow in record for the RGCP (Table 3.4-1). It was assumed that the recorded water elevation associated with the highest average month is indicative of the hydrologic floodway, or active floodway.

The hydrologic floodplain set the bounds (areal extent) for shavedowns and plantings. The assumption was that areas outside the hydrologic floodplain would require extensive shavedowns and/or large flow releases for development of native vegetation. In the case of plantings, sites outside the hydrologic floodplain would be too high above the water table for success. Details concerning the selection of restoration areas is found in Section 2.

Table 3.4-1 Reference Flows Used to Identify Hydrologic Floodplain

Flow (cfs)	Upper Rincon	Lower Rincon	Seldon Canyon	Upper Mesilla	Las Cruces	Lower Mesilla	El Paso
River Mile	*105 – 90*	*90 - 72*	*72 - 63*	*63 - 50*	*50 - 40*	*40 - 21*	*21 - 0*
Irrigation season average *	1,150	1,150	1,200	1,000	1,000	650	650
Design flow (USACE 1996)	2,350	2,350	2,350	1,900	1,900	1,600	1,600
Flows selected as a reference for riparian habitat development **	3,561	3,470	3,470	3,035	3,270	2,545	2,586

* Approximate values from El Paso-Las Cruces Regional Sustainable Water Project (USIBWC and EPWU/PSB, 2000)

** Highest average monthly flow on record (July 1987) during a 10-consecutive year period with the highest precipitation from USACE 1996, Vol. 4, Tables 2-2, 2-4 and 2-6.

Approximately 350 acres of ROW were calculated within the hydrologic floodplain and met the criteria for riparian restoration. An additional 771 acres of lands outside the ROW, primarily within or adjacent to Seldon Canyon were also identified (Table 3.4-2). Note: the table does not reflect floodway inundation by raising the river elevation above the hydrologic floodplain through increasing flow as identified in the targeted river restoration alternative.

Table 3.4-2 Lands Within the Hydrologic Floodplain and Meeting Criteria for Potential Environmental Measures

	Upper Rincon	Lower Rincon	Seldon Canyon	Upper Mesilla	Las Cruces	Lower Mesilla	El Paso	Total
River Mile	*105 - 90*	*90 – 72*	*72 - 63*	*63 - 50*	*50 - 46*	*40 - 21*	*21 - 0*	*105-0*
Within RGCP ROW	137	60	0	20	137		0	350
Outside RGCP ROW		208	324		168	27	44	771
Total	137	268	324	20	305	27	44	1121

Wetlands

Wetlands have undergone considerable modification in recent history. Wetlands were found throughout the Rio Grande floodplain created by a dynamic river system responding to heavy snow melt or storm generated runoff. The presence of abundant and mosaiced wetlands interspersed among riparian vegetation was driven by seasonal rain and basin hydrology (Crawford et al., 1996). By some accounts, wetlands extent increased in response to widespread landuse changes which modified river hydrology, raised water tables and created saturated soil conditions (Wozniak 1995).

As recently as the early 1900s, high water tables in the floodplain created many wet meadows, marshes and ponds providing habitat for wildlife and subsequently reducing its value as cropland. In response to saturated soil conditions, extensive drainage canals were built in the 1920’s to remove water and improve agricultural productivity. The drainage eliminated the majority of wetlands by the 1930s thereby increasing the importance of the remaining wetlands found among the irrigation network and river margin (Wozniak 1995).

Within the RGCP, wetlands are largely restricted to narrow margins and former oxbows within the floodway. High water tables during irrigation season have created pockets of emergent marsh and wet meadow sites within the floodway and on private lands adjacent to the ROW. The two most significant wetlands on private lands adjacent to the ROW are found at the entrance to Seldon Canyon and south of Las Cruces. Not coincidently, both areas area also mapped as being within the hydrologic floodplain.

Wetlands estimate within the RGCP is heavily influenced by the classification system and classification methodology employed. Table 3.4-3 compares wetland estimates developed for this Environmental Impact Statement (from Parsons 2001a) with an earlier inventory conducted by the USFWS National Wetland Inventory program (from CH2M-Hill and GeoMarine 2000a). Analyses of representative areas suggest that much of the wetland previously identified by the National Wetland Inventory are currently classed as riparian herbaceous or shrubland (in areas south of Las Cruces), and riparian shrubland/woodland in the Rincon Valley. As a result, wetlands mapped by Parsons (2001a) typically reflect the locations of "wetter" wetlands.

Table 3.4-3 Wetland Inventory from Two Sources

Source	Upper Rincon	Lower Rincon	Upper Mesilla	Las Cruces	Lower Mesilla	El Paso	Total
1979 National Wetland Inventory	18	100	20	164	59	236	597
Parsons 2001a	54	51	2	15	9	35	166

The difficulty of separating wetlands from riparian areas has resulted in some mapping efforts not distinguishing between wetlands and riparian habitat. For instance riparian areas mapped by the Colorado Division of Wildlife, are inclusive of wetland areas and no mapping distinction is made between riparian vegetation and wetland vegetation (Colorado Division of Wildlife 1997). The variability of mapping wetlands from remotely sensed imagery underscores the importance of conducting on-site wetland determination for future regulatory compliance. The definition of jurisdictional wetlands follows:

Jurisdictional wetlands (waters of the United States) are defined in the Clean Water Act and the Code of Federal Regulations. Waters of the United States are delimited by the "ordinary high water mark," a term defined as that line on the shore established by the fluctuations of water and indicated by physical characteristics such as clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas (33 CFR part 328).

Wetlands are categorized as waters of the United States and defined as those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soils conditions. Wetlands generally include swamps, marshes, bogs, and similar areas (Federal Register 1980, 1982).

Wetlands determination and delineation methods are described in the United States Army Corps of Engineers 1987 Wetlands Delineation Manual (USACE 1987). This manual with amendments provide guidance for determine the extent of jurisdictional wetlands. On-site jurisdictional wetland determinations might or might not correspond to existing wetlands maps.

3.4.3 Vegetation Communities Descriptions

USIBWC ROW lands encompass 11,062 acres of terrestrial and open water. Table 3.4-4 presents the distribution of vegetation communities. The system used for mapping vegetation was a modified version of the Texas Parks and Wildlife Department vegetation classification system (Hinson and Pulich 1995).

Table 3.4-4 Vegetation Communities and Open Water Habitat Within the RGCP

Vegetation Community	Upper Rincon	Lower Rincon	Seldon Canyon	Upper Mesilla	Las Cruces	Lower Mesilla	El Paso	Totals
Riparian (floodway)								
Herbaceous	303	542	14	289	459	399	555	2551
Herbaceous – on levees	46	154		46	131	217	154	748
Woodland	380	196	8	242	195	264	160	1,445
Shrubland	302	305	4	117	38	49	24	839
Exposed ground	276	101	0	138	36	111	40	702
Croplands	40	26	0	0	0	0	0	66
Wetlands - Emergent marsh	42	31	2	15	11	29	10	140
Wetlands – Palustrine Woodland	12	20	0	0	3	1	1	37
Total Riparian (acres)	*1,401*	*1,375*	*28*	*836*	*873*	*1,070*	*944*	*6,527*
Uplands								
Herbaceous	789	83	0	0	0	0	0	872
Woodland /Shrubland	721	51	0	0	0	0	0	772
Exposed ground	131	30	0	0	0	0	0	161
Total Upland (acres)	*1,641*	*164*	*0*	*0*	*0*	*0*	*0*	*1,805*
Total Land Acreage	**3,042**	**1,539**	**28**	**836**	**873**	**1,070**	**944**	**8,332**
Open Water	271	541	263	292	420	498	445	2730
Total Acreage for the RGCP	**3,313**	**2,080**	**291**	**1,128**	**1,293**	**5,168**	**989**	**11,062**

A detailed discussion of the classification process was presented in a separate technical report documenting status of RGCP habitats (Parsons 2001b). In brief, the classification process used a combination of supervised and unsupervised image processing techniques to classify color infrared orthoimagery. The primary benefit of using image processing techniques for vegetation classification is its capability to efficiently classify extensive areas. Limitations can include potential error between spectrally similar classes (referred to as omission or commission error) and subsequent under or over representation of some classes. Despite potential limitations, the resulting maps provided the most accurate estimate of vegetation communities available for the RGCP to date.

Vegetation communities are classified as either riparian (the floodway) or upland vegetation (Table 3.4-4). Wetlands are part of the riparian community. Within each class, more detailed physiognomic classes are defined. Within the riparian community, the wetter areas are classified as wetlands. Some riparian areas are cropped within the ROW.

Riparian Communities and Wetlands

Herbaceous. Due to mowing, much of the riparian community is maintained in an early successional state and classified as herbaceous. Herbaceous communities include non-woody vegetation such as grasses, sedges, and forbs with less than 20 percent cover in trees and shrubs. This community corresponds to Hink and Ohmart Type VI open grassland or emergent community. Although the herbaceous community is diverse (87 species documented), many non-native, invasive, and noxious species such as Russian thistle, red bladderpod, and jimson-weed occur. Many of the plant species are opportunistic, early successional species which are often indicators of disturbance. With the exception of Seldon Canyon, the herbaceous class is abundant throughout the RGCP.

Within the floodway, herbaceous lands are normally characterized as intermediate to xeric grasslands. Xeric grasslands are located on the levees and higher sites within the floodway. Approximately 748 acres of grasslands are part of the levee. Isolated lower sites are composed of mesic vegetation at times transitioning into Hydric (wetland) communities. In the absence of mowing, herbaceous areas would likely convert to a woody salt cedar community.

Woodlands. Woodlands are dominated by woody vegetation over 9 feet tall and with a minimum canopy cover of 20 percent. This community corresponds to Hink and Ohmart Type III woodland, and is also referred to in this document as bosques. Woodlands consist of native and non-native woody species, with native species rarely dominating. The dominant species in this community is invasive salt cedar. Common native species include honey mesquite, littleleaf sumac, peachleaf willow, and occasional cottonwood.

Shrublands. Shrublands are characterized as areas dominated by woody vegetation less than 9 feet with a canopy cover less than 20 percent. This community corresponds to Hink and Ohmart Type V dense shrub community. Within the RGCP, the dominant species in the shrubland is salt cedar. The shrubland class is similar in species composition of the woodland community. Common native species in this class include apache plume, aromatic sumac, baccharis, fourwing saltbush, and pale wolfberry. Shrublands dominated by willow/seepwillow often transition into palustrine wetlands. Due to the changes in vegetation as a result of the mowing there is a significant overlap between shrubland and herbaceous communities. Permanent shrubland habitat is found closer to the river or in other areas more difficult to mow.

Exposed Ground. This land cover classification is characterized by the absence of vegetation and includes bare soil, sand, silt, and gravel and vegetation, if present, is very sparse. Bare ground accounts for a significant amount of the floodway. A recent study in the RGCP using a transect sampling method found that in over half of survey sites (18 of

35 sites), bare ground was actually the dominant land cover type and in 11 sites, it was the second most dominant land cover type (Watts 1998).

Cropland. Croplands include alfalfa, chili, corn, cotton, pecan and a number of other crops. These agricultural areas make up a small percentage of the land cover within the floodway.

Wetlands. Wetlands are those areas where water saturation is the dominant factor determining soil development and the types of plants and animal communities present (Cowardin *et al.,* 1979). Wetlands are found on sandbars near the center of the channel, river margins or in proximity to the mouths of arroyos (Parsons 2001c). Wetlands are also found in the floodway where groundwater is at or just below the surface. These wetlands are classified as palustrine woodlands or emergent marsh.

- The emergent marsh class is dominated by herbaceous vegetation such as bulrush, cattail, and horsetail. Non-native, or noxious species include Johnsongrass, downy brome, and careless weed. Hydrology is a function of rainfall, episodic flooding, and depth of water table. The majority of wetlands in the RGCP are classed as emergent marsh. Emergent marshes are primarily found in the Upper Rincon, Lower Rincon and Lower Mesilla RMUs. Two fairly significant emergent marsh areas are located on private property north of Seldon Canyon and south of Las Cruces. Both areas are within potential conservation easements.
- Palustrine woodlands are dominated by facultative to obligate woody wetland vegetation. The class is characterized by mixtures of native and non-native plant species found in moist soil conditions. Willow/seepwillow cover types found in saturated soil conditions fall within this category. Depending on hydrologic regime, cottonwood bosques can be classified as palustrine woodlands or riparian woodland. Palustrine woodlands characterized by native species are rare, and when found, occur as narrow isolated pockets. The majority of native dominated palustrine woodland sites are found in the Upper Rincon RMU. Palustrine woodlands can include species such as New Mexico olive, baccharis, false indigo bush, and wolfberry (Scurlock 1998).

Uplands

The uplands represent lands outside the historic floodplain and are dominated by xeric plant species. Grazing in the uplands has reduced populations of some grasses, and the grass communities with grazing tolerant forbs and shrubs. These communities include less palatable species such as snakeweed and shrubs such as saltbush and salt cedar (Scurlock 1998; Stotz 2000).

Woodland/shrubland. The woodland/shrubland community includes non-agricultural trees but will occasionally include drier former agricultural lands dominated by woody vegetation (over 20 percent woody coverage). Shrublands are mostly less than 9 feet in height and over 20 percent canopy cover. The majority of the woody upland sites are shrubland class.

Herbaceous. Herbaceous lands include all non-woody vegetation including grasses and forbs. Herbaceous areas are composed of less than 20 percent woody cover. Recent studies of upland vegetation suggest that ground coverage is often less then 20 percent within this and other uplands classes (USACE 1997).

Exposed Ground. Exposed lands are relatively abundant in the northern reach of the RGCP and include bare soil, sand, silt, and gravel. This land cover classification is defined by the absence of vegetation (<5 percent coverage). Vegetation, if present, is sparser than in vegetated land use classifications. Exposed ground is often interspersed within herbaceous and woodlands.

3.4.4 Invasive Species

Salt Cedar

Several species of salt cedar were introduced into the United States from southern Europe and the eastern Mediterranean region in the late 1800s. Many of these species escaped cultivation, and spread rapidly throughout the riparian areas of the southwest. Salt cedar has several characteristics that make it well suited to the desert regions of the southwest.

Salt cedar is considered a facultative phreatophyte able to survive in conditions where groundwater is depleted and the soil is unsaturated (DiTomaso 1998). Salt cedar can survive drought conditions longer than cottonwoods and willows, and can then rapidly respond to the presence of water (Devitt *et al*., 1997) and may desiccate watercourses (Vitousek 1990; DiTomaso 1998). In addition to the ability of salt cedar to tolerate drought and saline conditions, there is some evidence that the fire regime of these riparian areas may be altered by the presence of salt cedar (Bock and Bock 1990; Smith *et al*., 1998). Salt cedar is relatively tolerant of fire, while most native riparian species are not.

Salt cedar is the dominant woody species found in the riparian and wetland vegetation communities of the RGCP. It would likely dominate the majority of the floodplain replacing herbaceous communities if mowing ceased. Salt cedar tends to release seeds later in the season than cottonwood or willow, starting about the middle of July (Gladwin and Roelle 1998), but salt cedar release seeds for a much longer period of time (up to 5 months) and the seeds are viable for up to 3 months after release (USBR 2000). Salt cedar requires bare moist soil for germination, similar to the conditions required by cottonwood and willow. However, the longer period of release provides salt cedar with the ability to germinate later in the season when water flows are declining, including after late summer monsoonal rains (USBR 2000).

Salt cedar removal is a labor intensive process often requiring a combination of mechanical, manual and chemical treatments (Sudbrock 1993). Seasonal, long-term flooding can be a successful alternative when the salt cedar seedlings are small and they can be completely inundated (Gladwin and Roelle 1998).

Russian Olive

The Russian olive has also become established within many riparian areas of the southwest. Russian olive was introduced into the United States in the late 1800s, and subsequently escaped cultivation (Olson and Knopf 1986). Russian olive is a rapidly growing plant with a deep taproot and extensive lateral branching (Borell 1971). The Russian olive can effectively compete with native species for space and water, and is a superior competitor on bare mineral substrates due to nitrogen fixing root nodules (Plant Conservation Alliance 1997). Russian olive is considered relatively salt tolerant, although not as salt tolerant as salt cedar (Olson and Knopf 1986; Vines 1960), and is often found as a co-dominant species with willow. It is generally considered inferior wildlife habitat to native riparian species (Olson and Knopf 1986).

Russian olive is most prevalent in the northern reaches of the RGCP. Generally, the easiest way to control Russian olive is with a regime of mowing and removing the cut material. However, the seeds of the Russian olive are readily dispersed by many birds, so if mowing were reduced in some areas, this plant may become more abundant.

Russian Thistle

Russian thistle (*Salsola kali*), also known as tumbleweed, was introduced into the United States in the late 1800s. It has colonized extensive areas within the RGCP, particularly in disturbed sites in response to grazing and mowing. The seeds of Russian thistle are dispersed when the plant dries and wind tumbles the dried plant to a new location. Russian thistle is a particular problem in agricultural areas because of its extensive seed bank and water use. Research in croplands indicates that Russian thistle may be able to extract water from deep in the soil profile (Schillinger and Young 1999), potentially lowering the water table.

Control of Russian thistle is primarily through chemical controls and occasionally with mechanical controls (e.g., tilling). Chemical control is preferred because of the seed bank that is often exposed when mechanical control methods are used.

3.4.5 Vegetation Management within the ROW

Vegetation management affects the floristic and structural characteristics of vegetation communities. Vegetation management is conducted to reduce the amount of vegetation and potential obstructions within the ROW. The USIBWC manages the floodway vegetation primarily by mowing and grazing. Table 3.4-5 presents vegetation management by habitat type.

Leased Areas

Grazing Leases. Grazing allotments are leased to private ranchers, the grazing animals on these allotments are cattle and horses. Agricultural and grazing leases require that brush and vegetation be removed or mowed annually within portions of the lease. Additionally, no permanent structures may be constructed. Table 3.4-6 lists the acreage leased by RMU (Smith 2000).

Table 3.4-5 Vegetation Management Within the ROW

Current Vegetation Management	Acres for Entire RGCP	Acres by Habitat Type		
		Wetlands*	Riparian (excluding wetlands)	Uplands
No mow zones	57	0	57	0
Crop leases	66	0	66	0
Annual mowing**	4,657	124	4,533	0
Grazing leases	3,552	53	1,694	1,805

* Boundaries of grazing and mowing zones are not clearly delineated; therefore wetland area was proportionally assigned to vegetation management type.
** Includes areas used for recreational purposes (Section 3.8.3)

Table 3.4-6 Acreage Leased in the RGCP

RMU	Habitat Type	Leased Area (acres)
Upper Rincón	Upland and Riparian	1,911
Lower Rincon	Upland and Riparian	473
Upper Mesilla Valley	Riparian	638
Las Cruces	Riparian	136
Lower Mesilla Valley	Riparian	256
El Paso	Riparian	138
Total Area Leased	***Upland and Riparian***	***3,552***

Crop Easements. An estimated 66 acres of floodway is leased for crop production in the Rincon Valley. The majority of the land is in row crops, however pecans are grown in the Lower Rincon Valley within the east floodway.

Mowed Areas

Annual Mowing of Floodway. Mowing of the riparian zone controls weed, brush, and tree growth, and is conducted at least once each year prior to July 15. Farm tractors with rotary slope mowers are generally used to mow the floodways. Slope mowers are used for vegetation maintenance on the channel banks. Some areas with dense vegetation may require a second late summer mowing. Approximately 4,657 acres are potentially mowed within the floodway (Table 3.4-7). However, the actual area mowed is less because some areas within the ROW are either inaccessible or heavily wooded. Based on field observations conducted during the mowing season, mowers frequently work around well-established woodland patches in designated mow area and have been directed to avoid some native stands. The actual acreage cut by Slope mowers, is estimated at 80 percent of the potential area mowed or approximately 3,725 acres.

No-Mow Zones. Approximately 57 acres of no mow zones are located in the Upper Rincon and Las Cruces RMU. Since 1999 the USIBWC has conducted limited tree planting and maintained provisional test areas (“no-mow” zones) intended to evaluate effects of additional vegetation growth on RGCP functions.

Table 3.4-7 Salt Cedar Control Within the Floodway

Method	Acreage	Comments
Grazing Leases	1,747	Based on a review of aerial imagery, potentially 30% of leased riparian areas are woodlands dominated by salt cedar. As such, active salt cedar control is estimated at 1,222 acres of floodway by lease holders. The remaining areas are grazed woodlands.
Mowing	4,657	Based on a review of aerial imagery, potentially 20% of mowed areas are woodlands mostly dominated by salt cedar. As such, mowing for the purpose of salt cedar control is estimated at approximately 3,725 acres of floodway. The remaining areas are unmanaged woodlands or areas otherwise avoided due to lack of accessibility or protection for designated areas.

Salt Cedar Control Methods

Mowing of Floodway. The USIBWC manages salt cedar through mowing by USIBWC staff or as part of lease agreements in which lessees agree to mow/control salt cedar on leased property. Table 3.4-7 lists acreage of salt cedar control efforts for the floodway. Additional discussion concerning vegetation management is found in subsequent sections.

Other Removal Methods. A variety of salt cedar treatment techniques have been developed. The preferred method is site-specific and often involves a combination of techniques. Techniques include fulmination (prescribed burning), mechanical removal (bulldozers and other machinery), manual (chain saws) and chemical applications. Descriptions of the common methods of salt cedar removal are listed below (SWEC 2002):

Cut-Stump/Herbicide Method. The cut-stump/herbicide removal method involves using hand crews to remove the salt cedar stands with chainsaws. Immediately after cutting the tree, an herbicide such as Garlon-4 (triclopyr) is applied with a paintbrush directly to the exposed stump. This allows the exposed vascular system of the plant to carry the herbicide throughout the root system. This method is only effective from April through October, when the salt cedar trees are actively storing nutrients.

Bull Dozer and Root Plow/Rake. This method involves removing the vegetation by prying, pulling, or pushing the salt cedars out of the ground with a bull dozer. The area is then root plowed and raked to remove the root crowns and lateral roots. In order to ensure adequate root removal, two passes with both the root plow and root rake are recommended.

Boss Tree Extractor. This removal method involves the use of a large tracked machine with a claw-type boom arm attachment. The claw is used to grasp the tree and pull the tree and the root crown vertically from the soil. The machine can stack debris in piles as it clears a 60-foot swath in a single pass.

Prescribed Burn/Herbicide Method. This method involves the foliar application of herbicide (aerial or manual). The resulting dead vegetation is allowed to desiccate for 2 years before a prescribed burn is used to remove the standing snags.

3.5 WILDLIFE HABITAT

Riparian areas constitute less than one percent of the land area in the arid southwestern landscape yet provide habitat to a greater number of wildlife species than any other ecological community in the region. They are also critical corridors for migratory species (USACE 2003). Hink and Ohmart (1984) found that riparian areas are used extensively by most bird species in New Mexico and at various times of the year riparian areas support the highest bird densities and species numbers in the Middle Rio Grande. To quantify wildlife value for the RGCP, habitat was characterized using the Wildlife Habitat Appraisal Procedure (WHAP) developed by TPWD (1995).

3.5.1 Quantification of Habitat Value

Habitat quality was based on the concept of Habitat Quality (HQ). The process of calculating HQ and Habitat Units (HU) are described in the WHAP technical report (Parsons 2001a). In brief, HQ is an index between 0-1 with 0 the lowest value and 1 the highest. The HU is value calculated by multiplying the HQ index of a landcover class by the area of the landcover class. Typically WHAP is used for quantitatively determining effects to wildlife habitat quality and is used as a comparative tool to assess habitat quality effects and changes in HU for a given area. Table 3.5-1 (modified from CH2M-Hill and Geomarine, 2000a) shows relationship between HQ and habitat quality.

Table 3.5-1 WHAP Ranking System Used in the RGCP

Habitat Quality Category	Habitat Quality
Poor	0.00 - 0.20
Below Average	0.21- 0.40
Average	0.41 - 0.60
Good	0.61 - 0.80
Excellent	0.81 - 1.00

The WHAP scores are based on the physical characteristics and associated vegetation and not intended to evaluate habitat quality in relation to specific wildlife species. Based in WHAP scores, overall wildlife habitat quality can be estimated for an area. Areas consisting of diverse, native communities in wetland like conditions are considered the best wildlife habitat (TPWD 1995). The poorest wildlife values are characterized by sites with low species diversity, little structure and in an early seral stages. Table 3.5-2 lists HQ scores for each vegetation community.

Wildlife Value of Wetlands

Wetland classes represent less than 2 percent of RGCP, but are characterized by the highest wildlife habitat scores. The palustrine woodland class, average 0.59 HQ value, is the highest HQ of all physiognomic classes. Native vegetation component, varied structure and saturated soil conditions is reflected in the relatively high score. The emergent marsh class (HQ value of 0.54) is indicative of average quality for wildlife. Average HQ scores are mostly due to low species diversity and small size.

Table 3.5-2 Habitat Units for the RGCP

Habitat Class	Average HQ Score	Habitat Quality	Area (acres)	Percent of the Floodway	Percent of ROW	Habitat Units
Riparian						
Woodland	0.52	Average	1,445	22%	16%	751
Shrubland	0.56	Average	839	13%	9%	469
Herbaceous	0.32	Below average	3,298	51%	37%	1,055
Exposed*	0.01	Poor	702	11%	8%	7
Cropland	0.20	Poor to average	66	1%	1%	13
Wetland emergent marsh	0.54	Average	140	2%	2%	75
Palustrine woodland	0.59	Average	37	1%	0%	21
Upland						
Herbaceous	0.32	Below average	872	N/A	10%	279
Woodland/shrubland	0.35	Below average	772	N/A	9%	270
Exposed*	0.01	Poor	161	N/A	2%	1
Total	**0.35**		**8,332**	**100%**	**100%**	**2,945**

*Surveys were conducted for exposed areas. All exposed lands assigned a value of 0.01 for calculation of the overall RGCP totals.

Wildlife Value of Riparian Lands

Riparian is the predominate vegetation class in the RGCP, accounting for over 76 percent of the total acreage within the ROW. Riparian areas represent areas with the most potential for environmental improvements and currently over 63 percent are below average to poor wildlife habitat quality.

Riparian woodlands and shrublands are widely distributed and characterized by average wildlife quality. The herbaceous class is the most common vegetation class with an average HQ score of 0.32 (considered of below average quality). The exposed class is found throughout the RGCP. Croplands are typically low wildlife habitat as a result of clean farming practices.

Wildlife Value of Uplands

Uplands account for nearly 22 percent of the total land cover and considered below average to poor. Upland areas are located outside the floodplain. The upland exposed class is intermixed within other upland classes. The upland herbaceous class has an average HQ score of 0.32 representing below average quality. The upland herbaceous class is intermixed with the upland woodland/shrubland class. Woodland/Shrubland wildlife habitat is below-average (HQ score of 0.35).

3.6 ENDANGERED AND OTHER SPECIAL STATUS WILDLIFE SPECIES

3.6.1 Threatened and Endangered Species

In preparation of this Environmental Impact Statement, four surveys were conducted, two terrestrial surveys and two aquatic surveys. A review of Threatened and Endangered (T&E) species was completed in separate biological survey reports (Parsons 2000a and 2001c). A Biological Assessment (Parsons 2003b) was also prepared. The reports concluded that suitable habitat for listed species is largely absent within the RGCP. The findings are consistent with previous studies of T&E species for the RGCP and adjacent areas (Ohmart 1994, USIBWC and EPWU/PSB 2000, CH2M-Hill & Geomarine 2000b, City of Las Cruces 2003, Parsons 2001). Table 3.6-1 lists habitat requirements for federally-listed T&E species potentially occurring in the Doña Ana, Sierra and El Paso Counties.

Most suitable habitat was found in areas adjacent to, but outside, the USIBWC ROW, such as Seldon Canyon (southwestern willow flycatcher) and on state property near Leasburg Dam. Sandbars and beaches along the river, more of which become exposed during periods of low flow, provide small amounts of habitat for waterfowl and the interior least tern. Table 3.6-2 shows the preferred habitat, and the potential for suitable habitat within the RGCP for the interior least tern, southwestern willow flycatcher, bald eagle, and whooping crane. The interior least tern is the only listed species to have been documented within the RGCP.

3.6.2 Species of Concern

Table 3.6-3 shows the species of concern (SOC) that occur in the area, and the potential for suitable habitat within the RGCP. To obtain the informal status of species of concern, a species must exhibit at least one of the following criteria (Biota Information System of New Mexico):

- Species considered to be in jeopardy in the RGCP counties and are species for whom habitat in these counties is critical for their overall existence;
- Species considered to be in jeopardy in RGCP counties and are generally declining throughout their range;
- Species believed to be in jeopardy in RGCP counties, but are not considered to be at risk overall; and
- Species not believed to be at risk in RGCP counties, but should be considered for conservation because of their ecological or social importance.

Migratory Birds and SOC

Little suitable habitat for the majority of migratory birds occurs in the RGCP. Two SOCs, the western burrowing owl and the white-faced ibis, were observed during the biological surveys. Both mature and immature owls were observed within the RGCP during field surveys. The burrows were located in the side of the levee road and in the

Table 3.6-1 Habitat Requirements for Federally-Listed T&E Species and Potential Presence within the RGCP

		Listing Status*					
Common Name	Scientific Name	Federal Listing	El Paso Co.**	Doña Ana Co.**	Sierra Co.**	Required Habitat	Potential Presence
Interior least tern	*Sterna antillarum*	E	E	E	---	River sandbars and beaches. Requirements correspond with unconsolidated shore/sandbars found within RGCP.	Potential habitat present
Northern aplomado falcon	*Falco femoralis septentrionalis*	E	E	E	E	Brushy prairie and yucca flats. Habitat not present based on literature review and detailed vegetation community maps.	Habitat not present
Southwestern willow flycatcher	*Empidonax traillii extimus*	E	E	E	E	Prefers brushy fields and thickets along streams. Has been documented in areas outside of and adjacent to the RGCP. Requirements correspond with Riparian Shrubland/Woodland and Palustrine Woodland found within RGCP	Potential habitat present
Sneed pincushion cactus	*Coryphantha sneedii var. sneedii*	E	E	E	---	Limestone ledges in the Chihuahuan desert and grassland at 4,300-5,400 feet. Habitat not present based on literature review and vegetation community maps.	Habitat not present
Mexican spotted owl	*Strix occidentalis lucida*	E	T	S	S	Dense coniferous forest. Habitat not present based on literature review and detailed vegetation community maps.	Habitat not present
Bald eagle	*Haliaeetus leucocephalus*	T	---	T	T	Prefers timbered areas along coasts, large lakes, and rivers. Requirements correspond with Riparian Shrubland/Woodland and Palustrine Woodland found within RGCP. Has been documented in northern reaches of the RGCP (southern Sierra County). Potential habitat in the form of snags, are most common in northern reaches of the RGCP.	Potential habitat present
Black-footed ferret	*Mustela nigripes*	E	---	S	S	Mixed shrub; associated w/ prairie dogs. Habitat not present based on literature review and detailed vegetation community maps.	Habitat not present
Whooping crane	*Grus americana*	E	---	E	E	Prefers marshes and prairie potholes in summer and winters in coastal marshes. Documented north of the RGCP at Bosque del Apache NWR (experimental population).	Potential habitat present
Chiricahua leopard frog	*Rana chiricahuensis*	C	---	---	S	Rocky slopes of springs, streams and rivers. Invades stock tanks. Habitat not present based on literature review and detailed vegetation community maps.	Habitat not present
American peregrine falcon	*Falco peregrinus anatum*	E	---	---	---	Cliffs, high river banks, large trees, tall buildings. Habitat not present based on literature review and detailed vegetation community maps.	Habitat not present
Arctic peregrine falcon	*Falco peregrinus tundrius*	E	---	---	---	Cliffs, high river banks, large trees, tall buildings. Rests at Texas coast during migration. Habitat not present based on literature review and detailed vegetation community maps.	Habitat not present
Piping plover	*Charadrius melodus*	T migratory	---	---	---	Beaches, sand dunes, sparsely vegetated areas along oceans, rivers and streams.	Potential habitat present
Gila trout	*Oncorhynchus gilae*	E	---	---	T	Small, high mountain streams. Habitat not presents based on literature review and detailed vegetation community maps.	Habitat not present
Todsen's pennyroyal	*Hedeoma todsenii*	E	---	---	E	Pinion juniper woodland, sandy gypsum soil, north-facing slopes. Habitat not presents based on literature review and detailed vegetation community maps.	Habitat not present

*USFWS. 1998. Threatened and Endangered Species of New Mexico. Albuquerque, New Mexico. pp 93. T- threatened; E - endangered; S – sensitive; C – candidate;

** County-specific state listings for El Paso County, Texas; Sierra and Doña Ana Counties, New Mexico. or El Paso County, Texas; Sierra and Doña Ana Counties, New Mexico.

embankment associated with concrete irrigation ditches. The white-faced ibis was observed on a vegetated sandbar at one location in the RGCP (Parsons 2001a).

Aquatic Species

Habitat for listed aquatic species does not occur within the RGCP. The Chiricahua leopard frog inhabits rivers and other aquatic habitats at elevations of 3,281 to 8,890 feet. The Rio Grande drainage is occupied by these frogs only in Alamosa Creek in Socorro County, New Mexico and Cuchillo Negro Creek in Sierra County, New Mexico. The Gila trout occurs in small, high mountain stream habitats, which do not occur in the RGCP (Table 3.6-1).

Table 3.6-2 Presence/Absence of Federally-Listed Species Habitat Based on Field Surveys

Species	Presence/ Absence Habitat Determination	Comments
Interior least tern	Limited habitat present	At least one interior least tern was observed during fall surveys in September 2000, presumably in the process of migrating south. The interior least tern is the only listed species to have been documented within the RGCP during field surveys. The tern was initially sighted in the Lower Mesilla Valley RMU, south of Mesilla Dam, in 2000. The solitary individual was observed in flight over the river and resting on unvegetated sand bars. Five additional sightings were made on the same date within 5 miles south of the first sighting, and may have been the same individual. Altered flow conditions in the river have eliminated any suitable nesting habitat in the RGCP; however, interior least terns may use the area for feeding or resting during migration.
Southwestern willow flycatcher	Habitat not present	Suitable habitat is nonexistent within the RGCP. The thickets of willow and/or salt cedar are not dense enough and do not meet the 10 m (30 feet) wide criteria. Vertical structure of thickets in un-mowed areas is not suitable and the current hydrologic regime does not provide for saturated soils. Potential habitat does occur in areas adjacent to the USIBWC ROW (Seldon Canyon, Leasburg State Park and Picacho wetlands restoration pilot project).
Bald eagle	Limited habitat present	Only marginal habitat (large trees) was found in the northern most portions of the RGCP near Percha Dam. Bald eagles have been sighted in previous studies in the northern portions of the RGCP.
Whooping crane	Habitat not present	The whooping crane's preferred habitat of marshes and prairie potholes is rare to non-existent in the RGCP. There are no prairie potholes, and marsh vegetation is generally confined to small sand bar islands, arroyo mouths, and spillways. In addition, the migratory path of the whooping crane has been extensively documented, and the crane has never been observed to use the RGCP area.
Piping plover	Limited habitat present	Suitable habitat for migrating birds potentially exists on sandbars, however, this plover is known only as a rare spring (April) migrant, having been verified at Springer Lake (Colfax County) and reliably reported at Bosque del Apache National Wildlife Refuge in Socorro Canyon. No sightings have occurred in the RGCP

Table 3.6-3 Summary of SOC Potentially Associated with Vegetation Communities in the RGCP

Species	Vegetation Community	Comments
Desert pocket gopher *Geomys bursarius arenarius*	Riparian herbaceous	Found in sandy river bottomland soils near irrigation ditches. This habitat is common throughout the floodway, however clayey soils are not tolerated.
Occult little brown bat *Myotis lucifugus occultus*	River	Forages over water, so may use river as foraging area. Arroyo areas for nesting may be of importance, as well.
Black tern *Chlidonias niger*	Emergent marsh	A small amount of emergent marsh habitat occurs in the project area. Gravelly areas for nesting are more common.
Loggerhead shrike *Lanius ludovicianus*	Riparian and upland	The shrike occurs in a variety of habitats, particularly where thorny shrubs or trees occur. Sites near arroyos may comprise suitable habitat.
Northern gray hawk *Buteo nitidus maximus*	Riparian woodland, palustrine woodland	Very little suitable riparian woodland habitat exists in project area, however, shrubland may provide an adequate prey base.
Western burrowing owl *Athene cunicularia hypagaea*	Riparian herbaceous, upland herbaceous, upland exposed	Suitable habitat exists in floodway, especially along grassland and open areas with suitable prey species.
Yellow-Billed Cuckoo *Coccyzus americanus*	Riparian woodland	Riparian woodlands do not have sufficient patch size and density to provide suitable nesting habitat.
White-faced ibis *Plegadis chihi*	Emergent marsh	Limited amount of suitable habitat, mostly on sandbars, islands, mouths of arroyos.
Texas horned lizard *Phrynosoma cornutum*	Riparian herbaceous, upland herbaceous, upland exposed	Suitable habitat exists in floodway and adjacent upland areas. Exposed uplands are favored, especially with bunchgrasses.
Arizona southwestern toad *Bufo microscaphus microscaphus*	Riparian woodland	Limited amount of suitable habitat in project area. Preferred habitat includes small streams and rivers, and temporary woodland pools. Adjacent arroyos may provide suitable habitat.
Anthony blister beetle *Lytta mirifica*	Croplands	Small amount of suitable habitat may occur in wetland margins and islands.
Desert viceroy butterfly *Limenitis archippus obsoleta*	Palustrine woodland, riparian woodland	Host genus is willow; therefore, potential habitat only occurs in limited areas where willow is still found. Also adjacent areas such as Seldon Canyon.
Pecos River muskrat *Ondatra zibethicus ripensis*	Emergent marsh	Small amount of suitable habitat may occur in wetland margins and islands. Preferred habitat is wetland or lowland riparian areas.

3.7 AQUATIC BIOTA

Aquatic biota was evaluated on the basis of field data obtained at multiple locations throughout the RGCP on September 2000 and January 2001 to document physical characteristics of the habitat and its potential supports fish and invertebrate species, and data on fish species composition (Parsons 2001c). Habitat quality was also evaluated on a theoretical basis using empirical indexes indicative of potential suitability for fish species, and a depth-velocity matrix that illustrates available conditions in the RGCP for reproduction of Rio Grande fish species.

3.7.1 Habitat Characterization

Field Survey Data

Data on physical characteristic of RGCP aquatic habitat were obtained from 10 sampling sites selected as representative of conditions on each of the seven RMUs. Two sites were surveyed at the Upper Rincon, Lower Rincon and Lower Mesilla RMUs. Table 3.7-1 characterizes sampling sites in terms of 6 physical features of the habitat and 7 attributes quantified on a 0 to 4 scale. Survey guidelines were obtained from (TCEQ 2001).

Instream habitat in the RGCP was characterized by low diversity in lotic habitat types. The river was characterized as an undifferentiated run with little pool/riffle structure. Instream cover, which provides essential habitat for different life stages of invertebrate and vertebrate life was very limited. The river channel has little to no sinuosity except in the upper reaches of RGCP that provides variation in velocity. Substrate was relatively unstable, predominantly silt and sand, which is generally considered the least favorable for supporting aquatic organisms both in terms of number of species and individuals. River banks were moderately stable to unstable. There was little overhanging riparian vegetation to filter light and lower instream temperatures. Livestock grazing was also observed in some sections of the floodway potentially impacting the aquatic habitat by increasing siltation and sedimentation. Greater aquatic habitat diversity, diversity of bottom types, backwater or low flow areas, and greater riparian vegetation were found at natural arroyos or agricultural spillways. Table 3.7-1 illustrates habitat characterization of representative areas within the RGCP.

3.7.2 Habitat Suitability

Depth-Velocity Matrix

Habitat preference in terms of water velocity and depth is an indicator of suitability for fish species, particularly as it applies to reproductive success of native species. Figure 3-5 illustrates data compiled in an USIBWC-sponsored study to assess habitat availability for native Rio Grande fish species (CH2M-Hill and GeoMarine 2000). The diagram represents a summary of native fish species reproduction preferences compared with water-velocity combinations likely to be found in the RGCP. Two flows regimes are illustrated representative of the main irrigation and non-irrigation seasons (1,000 cfs and 50 cfs, respectively). The comparison indicated that while depth requirements can be met in the canalized river, fast-moving water conditions prevalent in the RGCP during the irrigation season do not coincide with habitat preferences for reproduction.

Habitat Suitability Index

A Habitat Evaluation Procedure (HEP) developed by the USFWS was used to evaluate aquatic habitat. HEP can be used to document the quality and quantity of available habitat for selected fish and wildlife species. HEP provides information for two general types of habitat comparisons: 1) the relative value of different areas at the same point in time; and 2) the relative value of the same area at future points in time, facilitating "before" and "after" comparisons. HEP methodology information, support data, and findings for the RGCP are summarized in Appendix C. A more detailed discussion concerning HEP is found in Parsons (2001b).

The HEP is based on the assumption that habitat for selected fish and wildlife species can be described by a Habitat Suitability Index (HSI). This index value, ranging from 0.0 to 1.0, is multiplied by the area of available habitat to obtain Habitat Units that serve as the basis for comparison.

Limited availability of HSI models for species present within the RGCP led to the selection of two species for HEP analysis: largemouth bass and flathead catfish. Table 3.7-2 lists applicable HEP values for these species in the RGCP. Of three cover types available for the HSI calculations (riffle, pool and main river run), main river run was used as the basis for index calculation for the RGCP.

Index data indicated that RGCP conditions were more suitable for the flathead catfish than for the largemouth bass, but HSI values underscored the paucity of aquatic habitat available for both species in the RGCP (Table 3.7-2). For largemouth bass, (HSI ranging from 0.05 to 0.17), a large proportion of the RGCP is sub-optimal for species development. Physical conditions contributing to the largemouth bass reproductive success include percentage of total habitat represented by pools and backwaters and a possibly correlated variable, velocity of water in the pools. Most of the RGCP, percent pool values is less than or equal to 10 percent, significantly limiting the availability of optimal bass habitat. The highest HSI values for largemouth are downstream from diversion dams and siphons where pools or slow-moving waters are present. Little suitable habitat is in the main river run (HSI <0.1).

Calculated HSI values for the flathead catfish, while higher than those calculated for the largemouth bass, are also indicative of sub-optimal habitat conditions. Index values ranged from 0.10 to 0.55 depending on the location (Table 3.7-2). As with largemouth bass, locations downstream from diversion dams and siphons have the highest HSI values, indicating a positive relationship between the index and percent coverage of pools. For the main river run HSI values for the catfish were generally low, from 0.10 and 0.25. Results of the habitat suitability models suggest that augmenting pool habitat will likely be beneficial for both largemouth bass and flathead catfish.

Figure 3-5. Comparison Between Fish Habitat Preference and RGCP Habitat Availability at Two Reference Flows
(modified, from CH2M-Hill & GeoMarine 2000a)

HABITAT PREFERENCE BY LIFESTAGE [a]

DEPTH (feet)	*Lifestage: Sub-Yearling*	VELOCITY (feet per second) Quiet [c] (0 - 0.25)	Slow (0.26 - 0.75)	Moderate (0.76 - 1.5)	Fast (>1.51)
	Shallow (0.0 - 1.0)	**21%**	**13%**	6%	0%
	Moderate (1.1 - 3.0)	**21%**	**13%**	7%	0%
	Deep (> 3.0)	**11%**	6%	1%	0%

DEPTH (feet)	*Lifestage: Yearling +*	VELOCITY (feet per second) Quiet (0 - 0.25)	Slow (0.26 - 0.75)	Moderate (0.76 - 1.5)	Fast (>1.51)
	Shallow (0.0 - 1.0)	6%	3%	4%	3%
	Moderate (1.1 - 3.0)	**13%**	**11%**	**10%**	6%
	Deep (> 3.0)	**14%**	**15%**	**10%**	5%

HABITAT AVAILABILITY BY FLOW [b]

DEPTH (feet)	*Flow: 50 cfs*	VELOCITY (feet per second) Quiet (0 - 0.25)	Slow (0.26 - 0.75)	Moderate (0.76 - 1.5)	Fast (>1.51)
	Shallow (0.0 - 1.0)	**16%**	**42%**	**19%**	3%
	Moderate (1.1 - 3.0)	0%	**12%**	6%	0%
	Deep (> 3.0)	0%	0%	0%	0%

DEPTH (feet)	*Flow: 1,000 cfs*	VELOCITY (feet per second) Quiet (0 - 0.25)	Slow (0.26 - 0.75)	Moderate (0.76 - 1.5)	Fast [d] (>1.51)
	Shallow (0.0 - 1.0)	0%	1%	8%	3%
	Moderate (1.1 - 3.0)	0%	0%	5%	**79%**
	Deep (> 3.0)	0%	0%	0%	4%

NOTES
a. Habitat preference is defined as the percentage of species/lifestages that prefer a given hydraulic category
b. Habitat availability is defined by the amount of a given hydraulic category as a percent of the total habitat available.
c. Habitat preference for spawning is largely restricted (nearly 60%) to quiet water at depths greater than 1 foot.
d. Velocities greater than 3 ft., unsuitable habitat at any depth, account for 18% of the total.

Values equal or greater than 10% for a given velocity-depth combination.

Table 3.7-1 Aquatic Habitat Characterization at Selected RGCP Sampling Sites

	Upper Rincon RMU		Lower Rincon RMU		Seldon Canyon RMU	Upper Mesilla RMU	Las Cruces RMU	Lower Mesilla RMU		El Paso RMU
Habitat Type	**Site 1**	**Site 2**	**Site 1**	**Site 2**	**Site SC**	**Site UMV**	**Site LC**	**Site 1**	**Site 2**	**Site EP**
Pool / Backwater Area	20%	0%	20-30%	10%	<10%	20%	<10%	<10%	30%	10%
Estimated Area >2m Deep	<10%	0%	<10%	0%	0%	15%	<10%	20%	10%	0%
Bottom Cove	30%	10%	0%	0%	<10%	<10%	<10%	<10%	0%	0%
Riparian Vegetation Type	Grasses, willow, seep-willow, salt cedar	Grasses, willow, seepwillow	Willow, cattails	Willow, Russian olive	Willow, salt cedar	Willow	Grasses, Willow	Grasses, willow, salt cedar	Willow	Grasses, willow
General Stream Type	Riffle, Pool	Run	Run	Run	Run	Pool, run	Run	Run	Run, backwater	Run
Instream Cover Types	All	Edge	Edge	Debris, rocks	Overhang	Veg., debris, rocks	Edge, overhang, rocks	Overhang, rocks, pools	Edge, pools	Rocks
Instream Cover	30-50%	10-30%	0%	10-30%	0%	10-30%	10-30%	10-30%	10-30%	0%
Riffles	Rare	Occasional	Occasional	Occasional	Rare	Rare	Rare	Rare	Rare	Rare
Pool Depth	2-4 ft	2-4 ft	2-4 ft	2-4 ft	2-4 ft	2-4 ft	>1 ft	2-4 ft	2-4 ft	>1 ft
Bank Stability	Moderately stable	Moderately stable	Moderately stable	Moderately unstable	Stable	Moderately stable	Moderately unstable	Moderately stable	Stable	Moderately stable
Riparian Cover	Wide	Moderate	Moderate	Moderate	Wide	Moderate	Narrow (<15 ft)	Narrow (<15 ft)	Moderate	Moderate
Bottom Substrate	Moderately stable	Moderately stable	Moderately stable	Moderately stable	Moderately stable	Moderately unstable	Unstable (silt, clay)	Unstable (silt, clay)	Unstable (silt, clay)	Unstable (silt, clay)
Channel Sinuosity	Moderate	None	Low	Low	Low	Low	Low	Low	None	Low

Table 3.7-2 Habitat Suitability Indices for Largemouth Bass and Flathead Catfish

River Management Unit*	Site Condition	Location (River mile)	Largemouth Bass HSI	Flathead Catfish HSI
Upper Rincon - site 1	Downstream from Diversion Dam	104.3	0.14	0.40
Upper Rincon - site 2	Main River Run	100.2	0.06	0.10
Lower Rincon - site 1	Downstream from Siphon	82	0.17	0.45
Lower Rincon - site 2	Main River Run	79	0.06	0.25
Seldon Canyon	Main River Run	71.8	0.06	0.25
Upper Mesilla	Main River Run	51.3	0.14	0.40
Las Cruces	Main River Run	45.8	0.05	0.25
Lower Mesilla – site 1	Downstream from Diversion Dam	40.2	0.17	0.55
Lower Mesilla – site 2	Main River Run	42.5	0.05	0.25
El Paso	Main River Run	5.0	0.05	0.25

Similarly to the methodology used for vegetation, habitat units were calculated for the aquatic habitat on the basis of acreage and HSI data. Table 3.7.3 presented the summary of HU analysis.

Table 3.7-3 Habitat Units by River Management Unit

River Management Unit	Area of Surface Water (acres)	Largemouth Bass HSI	Largemouth Bass HU	Flathead Catfish HSI	Flathead Catfish HU
Upper Rincon	271	0.05	14	0.25	68
Lower Rincon	541	0.05	27	0.25	135
Seldon Canyon	263	0.05	13	0.25	66
Upper Mesilla	292	0.05	15	0.25	73
Las Cruces	420	0.05	21	0.25	105
Lower Mesilla	498	0.05	25	0.25	125
El Paso	445	0.05	22	0.25	111
Total	2,730	0.05	126	0.25	628

3.7.3 Fish Species Composition

Field Surveys Conducted in Support of the DEIS Preparation

The Rio Grande between Caballo Dam and the City of El Paso supports a fish community of at least 22 species that includes channel catfish, white crappie, blue gill, common carp, river carpsucker, gizzard shad, black bullhead, flathead catfish, largemouth bass, green sunfish, and longear sunfish (Sublette *et al*., 1990). A total of 12 species were collected during September 2000 and January 2001 surveys of the RGCP (Parsons 2001b). Table 3.7-4 lists fish species collected an sampling location

Table 3.7-4 Fish Species Collected During Biological Surveys of the RGCP

Common Name	Scientific Name	Capture Location (Transect Series)	
		September 2000	January 2001
Western mosquitofish	*Gambusia affinis*	DA, MDD	MDD
Channel catfish	*Ictalurus punctatus*	UR, H, DA, SC, SP, EP	EP, DA
Green sunfish	*Lepomis cyanellus*	DA	
Bluegill	*Lepomis macrochirus*	UR	
Longear sunfish	*Lepomis megalotis*	UR, SP, EP	
Largemouth bass	*Micropterus salmoides*	UR, H, DA	H, UR
Fathead minnow	*Pimephales promelas*	H, DA, EP, UR	BM, DA, SA
Bullhead minnow	*Pimephales vigilax*	MDD	EP, BM
Flathead catfish	*Pylodictis olivaris*	H, SC, SP, EP	
Red shiner	*Cyprinella lutrensis*	H	
Common carp	*Cyprinus carpio*	H	H
River carpsucker	*Carpiodes carpio*	UR	

BM = Black Mesa, DA = Doña Ana, EP = El Paso, G = Garfield, H = Hatch, LC = Las Cruces, MDD = Mesilla Diversion Dam, SA = Sierra Alta, SC = Seldon Canyon, UR = Upper Rincon

Fish Species Collected at Artificial Structures

A 3-year monitoring program sponsored by the USIBWC was conducted to determine the effectiveness of the artificial in-stream structures constructed as mitigation for a Section 404 permit. Sampling was conducted at two vortex weirs, three embayments, and nine groins. Fish species collected by USFWS are listed in Table 3.7-5. At most of these locations, cyprinids were the majority of fish species encountered during sampling, and the numbers of fish were also low. Most fish were repeatedly encountered near the banks and overhanging vegetation.

Table 3.7-5 Fish Species Collected at USFWS Mitigation Sites

Common Name	Scientific Name
Bluegill	*Lepomis macrochirus*
Bullhead minnow	*Pimephales vigilax*
Channel catfish	*Ictalurus punctatus*
Fathead minnow	*Pimephales promelas*
Gizzard shad	*Dorosoma cepedianum*
Green sunfish	*Lepomis cyanellus*
Largemouth bass	*Micropterus salmoides*
Longnose dace	*Rhinichthys cataractae*
Red shiner	*Cyprinella lutrensis*
Spotted bass	*Micropterus punctulatus*
Threadfin shad	*Dorosoma petenense*
Western mosquitofish	*Gambusia affinis*
White bass	*Morone chrysops*
Yellow perch	*Morone americana*

3.8 LAND USE

This section summarizes existing land use within a 0.25 mile corridor outside the ROW within El Paso, Texas and Doña Ana County and Sierra County, New Mexico. The land use corridor assesses land potentially affected by river management alternatives found outside the ROW.

3.8.1 Land Use Analysis

Land use data was created using data from city, state, and federal agencies. Ownership information, aerial photograph interpretation, and fieldwork were utilized to augment and verify the land use information from the various agencies.

Digital land use layers were acquired from Doña Ana County. Doña Ana County's digital land use data contains information for the entire county. Areas that were designated vacant by Doña Ana County or not designated by either the county or city data were reclassified into one of the eleven land use categories through cross-referencing ownership information and/or interpreting aerial photographs.

El Paso County's digital land use data only contains information for portions of El Paso County that are not incorporated. Zoning was utilized for the area encompassed by the City of El Paso since the city was not included in the El Paso County land use data, and the City of El Paso has not completed the creation of digital land use data.

Sierra County does not have digital land use data; therefore fieldwork and ownership information obtained from the USIBWC archives was utilized to determine land use in Sierra County.

Other sources contacted for land use information include EBID, USBR, Rio Grande Council of Governments, SWEC, Mesilla Valley Economic Development Alliance (MVEDA), Paso Del Norte Watershed Council and the BLM. Three ownership databases were acquired and utilized during the land use classification process: Doña Ana County, BLM and USIBWC. The remaining vacant and unidentified land not included in the above databases, were determined through aerial photograph interpretation.

General land use categories were established based on the available agency data categories. The land use categories utilized by county and city agencies and the corresponding generalized land use categories are defined below.

Agricultural Lands. Specific land uses within this classification include agricultural farming, such as croplands and pastures, livestock, and orchards. Livestock includes areas used for the production of milk, eggs, or meat and areas utilized for grazing. Orchards were identified through aerial photograph interpretation. Orchards and other planted areas are maintained for the production of fruits or nuts. Land within this classification may be irrigated or non-irrigated.

Prime farmlands, protected under the Farmland Protection Policy Act, are not present in the anticipated area of direct influence of the RGCP.

Commercial Lands. Land uses within this classification include commercial office parks, shopping centers, wholesale and retail trade, central business districts, and areas of planned commercial use. Churches and cemeteries are also included in this category. Commercial lands are typically concentrated in central urban cores along major streets and highways, adjacent to residential or industrial areas.

Government. Government lands include city, county, state, and United States government owned land. Land owned or occupied by transportation authorities, solid waste, water, and/or sanitation facilities are also classified as government lands. For purposes of this project, state-owned parks are classified in a separate category.

Institutional. This land use class includes lands owned or occupied by schools, state universities, not-for-profit organizations, associations, and/or lodges.

Industrial Lands. Industrial lands include quarries, light and heavy manufacturing, construction, warehousing, and areas of planned industrial uses. These areas are also typically concentrated in central urban cores along major streets and highways, adjacent to residential areas or commercial lands.

Residential Lands. Residential areas comprise single-family and multi-family occupancy. The city and county land use designations and aerial photograph interpretation were utilized for the division of the residential areas within the land use corridor into three classifications: low intensity residential, moderate intensity residential, and high intensity residential.

- *Low Intensity Residential Areas*. This category includes areas with a mixture of residential units and vegetation, including crops. These areas most commonly include single-family housing units. Population density would be lower than in moderate and high residential areas.
- *Moderate Intensity Residential Areas*. This category is also a mixture of residential units and vegetation. These areas most commonly include single-family housing units and some row housing. Population density would be lower than in high residential areas.
- *High Intensity Residential Areas*. This category includes highly developed areas where people reside in large numbers. These areas have a high concentration of residential units. High intensity residential areas commonly include apartment complexes, mobile home parks, row housing, and subdivisions.

State Parks. State parks include recreational areas owned by state agencies. These parks have been established for various recreational activities, but are also used for flood control, scenic, historic, and wildlife management. The natural areas are valued for their aesthetic qualities and minimal urban development.

3.8.2 Land Use Corridor

Land use within the RGCP corridor was identified using major features including canals, laterals, irrigation ditches, and roadways as geographic boundaries. A land use corridor was then selected as the potential area of influence applicable to measures under consideration. The corridor was defined by the area that extends 0.25 of a mile beyond each side of the ROW. The corridor was then analyzed geographically quantifying acreage by land use in each RMU. In the Seldon Canyon RMU, where there is no ROW, the 0.25 mile land use corridor was measured from the river centerline. Land use information was available in GIS format for 92% of the corridor surface.

A total of 30,289 acres make up the 0.25 mile land use corridor along each side of the RGCP. Land uses include well-developed urban centers of commerce and residential areas, particularly in the regions of El Paso and Las Cruces. Areas of intensive agricultural activities, government lands parks also lie within the project area. The total acreage by land use category and percent cover by RMU are presented in Table 3.8-1. Land use maps in areas surrounding the RGCP are presented in Figures 3-6 through 3-9.

Agriculture is the largest land use category, accounting for approximately 63 percent of the land use corridor. Farming is the dominant agricultural land use, comprising 39 percent of the land use corridor. Orchards comprise 15 percent of the land use corridor while livestock make up 9 percent. Dairy products, cattle, and cotton are the principal agriculture in El Paso County. Cotton, pecans, chili and livestock are the principal agriculture for Doña Ana and Sierra counties (U.S. Department of Agriculture 1997).

Government lands comprise approximately 13 percent of the land use corridor, with the greatest proportion in the Upper Mesilla Management Unit. These areas contain city, county, state, and federal lands. City parks were also included in this category. La Llorona Park is located within the land use corridor in Doña Ana County. In addition, Mesilla Valley Bosque Park is in the initial development stages for this County. State parks comprise less than 1 percent of the land use corridor. Leasburg Dam State Park in New Mexico is the only state park located within the land use corridor.

Residential areas comprise approximately 18 percent of the land use corridor, with the greatest proportion in Las Cruces. The majority of residential lands are low intensity areas where apartments, mobile homes, housing developments and special residencies are dispersed along the project area. The moderate and high intensity residential areas are more commonly located near the cities of Las Cruces and El Paso.

Together, commercial, institutional, and industrial lands comprise less than 6 percent of the land use corridor. The majority of these areas surround the Cities of El Paso and Las Cruces; however, Seldon Canyon ranks highest in institutional lands among the seven management units.

3.8.3 Recreational Use

State and Private Recreational Areas

Due to the relatively restricted access to the Rio Grande, recreational opportunities have been available primarily at state and city parks such as La Llorona Park in Las Cruces, New Mexico. Two state parks are located within the project area. Percha Dam State Park, an 80-acre New Mexico state park, is approximately 60 miles north of the City of Las Cruces on the Rio Grande. Grassy space surrounded by cottonwoods, salt cedar, and Russian olive trees provide park visitors outdoor activities such as camping and bird-watching (State of New Mexico, 2003). Bird-watching at Percha Dam State Park is considered the best in the area with a variety of bird species in great numbers. Other recreational activities include fishing and swimming along the river.

Leasburg Dam State Park in New Mexico is located approximately 15 miles north of the City of Las Cruces. The dam was constructed in 1908 to channel water from the Rio Grande for irrigation into the Mesilla Valley. The 240-acre park offers fishing, canoeing, and kayaking along the river. Picnic areas, campsites, and a playground are located along the river bank (State of New Mexico, 2003).

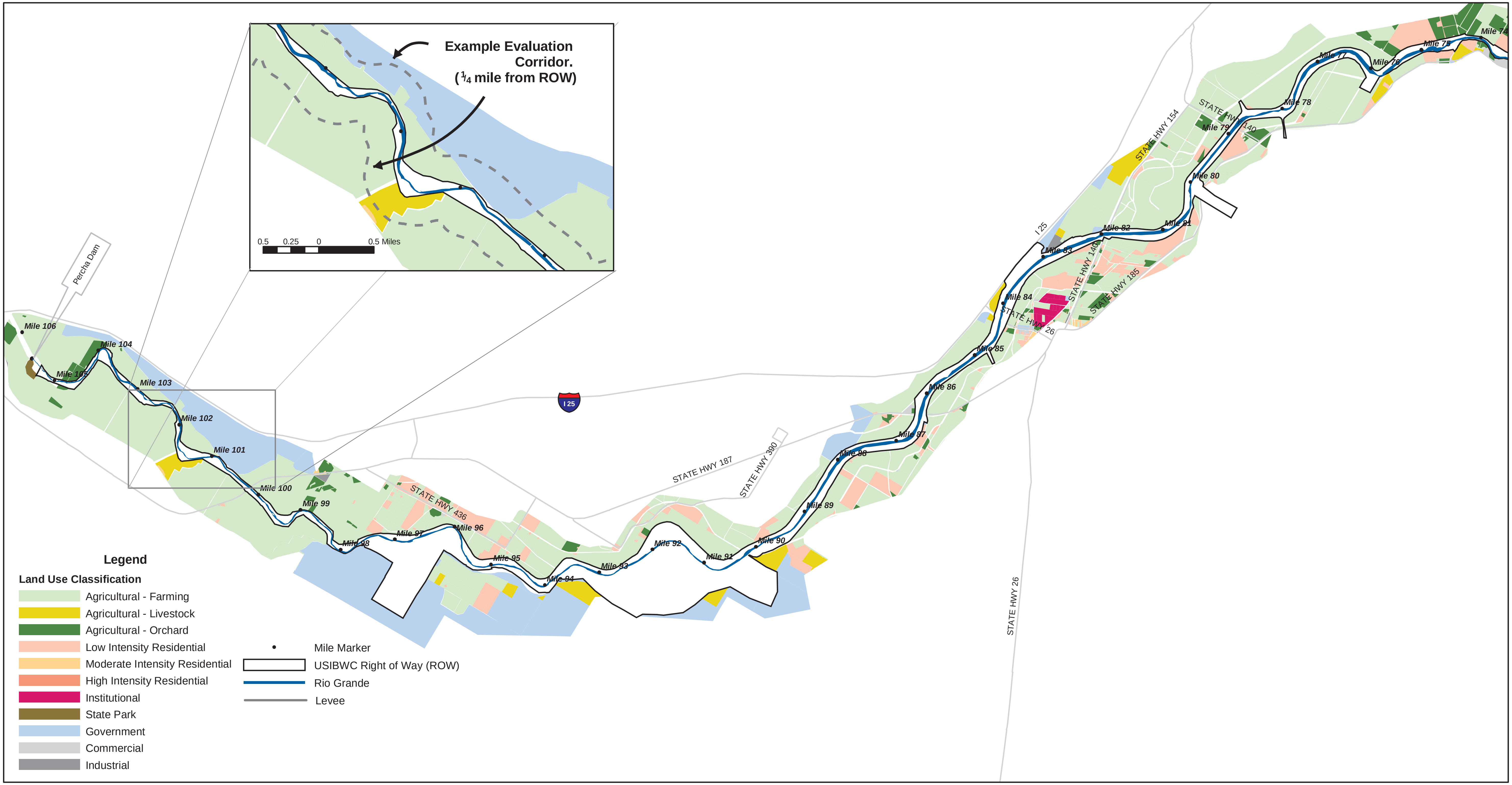
The privately-owned Anthony Country Club in Anthony, Texas borders the Rio Grande and offers visitors recreational golfing. The 62-acre, 9-hole golf course is located on the east bank of the river; approximately 33 acres utilizes the river floodway [*http://thegolfcourses.net/golfcourses/NM/4045.htm*].

Cooperative Initiatives Within the ROW

The USIBWC is participating in various initiatives, proposed or currently underway, to increase recreational opportunities and expand public access to the RGCP natural resources.

Rio Grande Riparian Ecological Corridor Project. In June 2000, the City of Las Cruces received an award from the USEPA Sustainable Development Challenge Grant program to create the Rio Grande Corridor Project (City of Las Cruces 2003). The Project encompasses a distance of 11 linear miles, from the Shalem Colony Bridge to the Mesilla Dam, and is envisioned for both the western and eastern banks of the southern Rio Grande. The extent of RGCP leased lands is 475 acres. The projects would involve cooperative agreements from the USIBWC and a number of other agencies which operate and maintain projects along the Rio Grande. Some of the projects include sites within the floodway identified in the AFR as potential areas for environmental improvements (Parsons 2001a). The project is the proposed site of the Mesilla Valley Bosque State Park that will include a multi-use trail along the east bank of the river (Schurtz, 2002).

Rio Grande River Park. The Rio Grande River Park is a project proposed for construction in phases as part of redevelopment of downtown El Paso, Texas. The National Park Service Rivers and Trails Program provided planning assistance, and the USIBWC provides access to a portion of the trail corridor. It would include an approximately 80-acre linear park and a trail for hiking, running, biking, and roller blading along the Rio Grande adjacent to downtown El Paso. The park would extend from the eastern edge of the Chihuahuita neighborhood adjacent to the international border crossing area at Santa Fe Street, to the Hart's Mill and Old Fort Bliss approximately 1.5 miles upstream. The river park was supported by the 1998 designation of the Texas portion of the Rio Grande as an American Heritage River, a White House initiative to help communities alongside their waterfronts preserve the rivers' histories and support natural resources and environmental protection. The extent of RGCP lands leased for the Rio Grande River Park is 101 acres.



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0 2.5 5 10 Kilometers

0 1.5 3 6 Miles

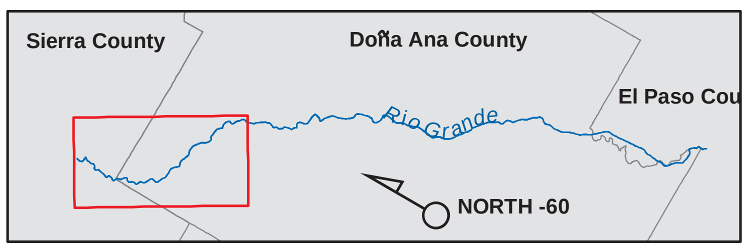

Figure 3-6
Land Use Classification: Miles 75-105

United States Section,
International Boundary Water Commission
December 2003

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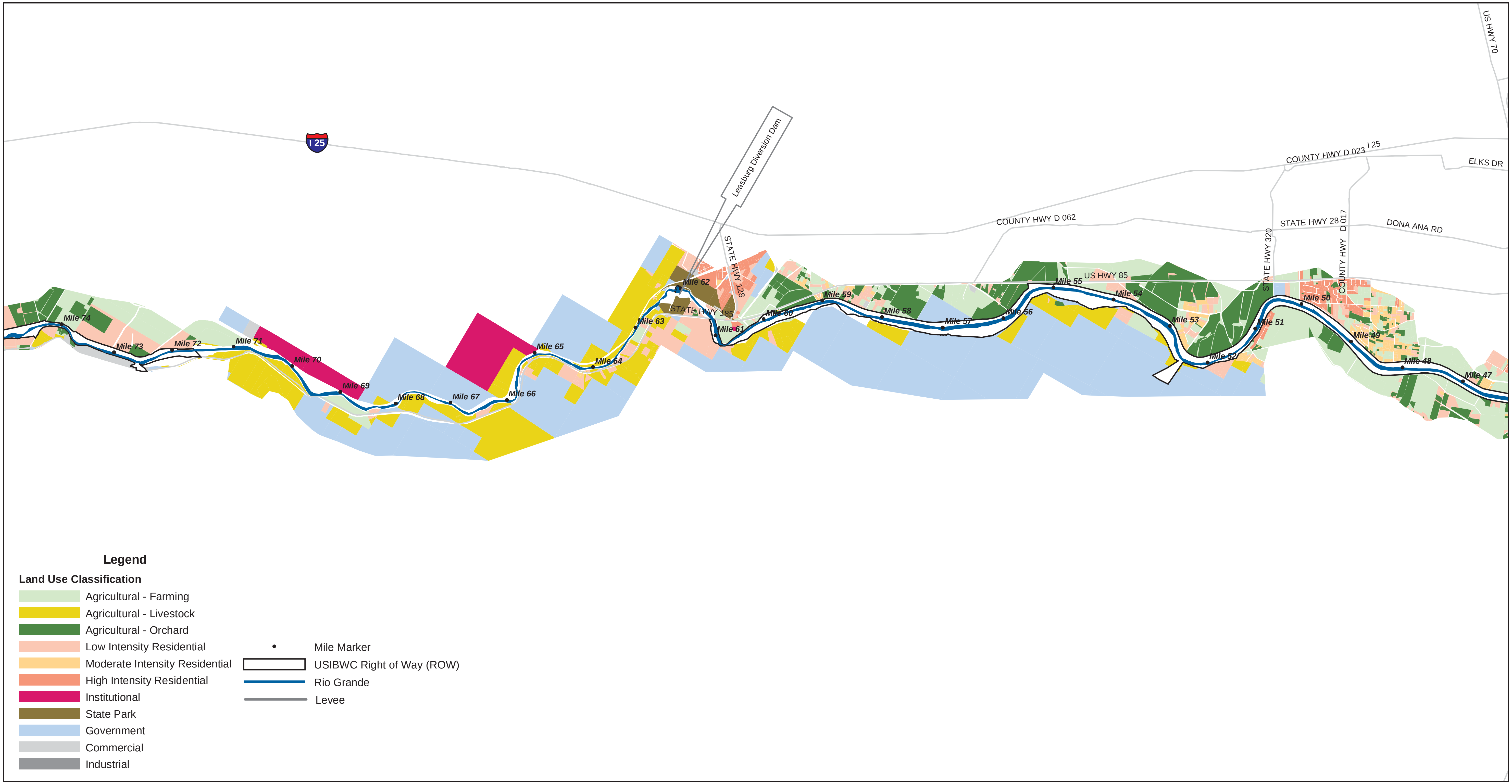

NORTH -60

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0 2.5 5 10 Kilometers

0 1.5 3 6 Miles

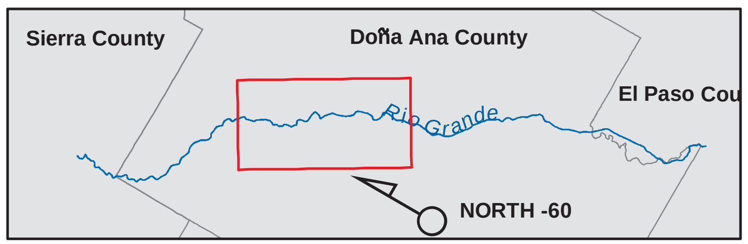

Figure 3-7
Land Use Classification: Miles 47-75

United States Section,
International Boundary Water Commission
December 2003

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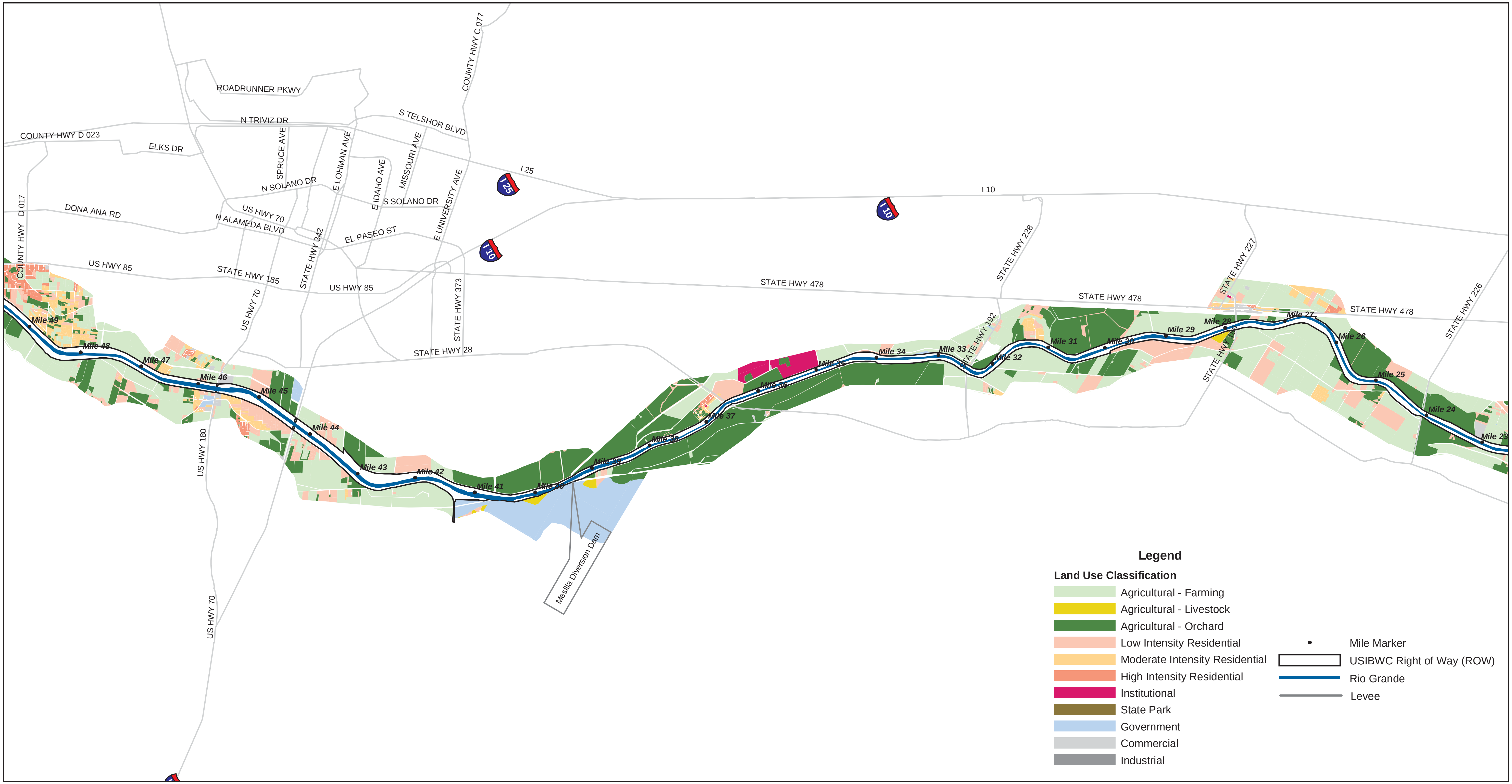

NORTH -60

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UTM Zone 13 N / NAD 83

0 2.5 5 10 Kilometers

0 1.5 3 6 Miles

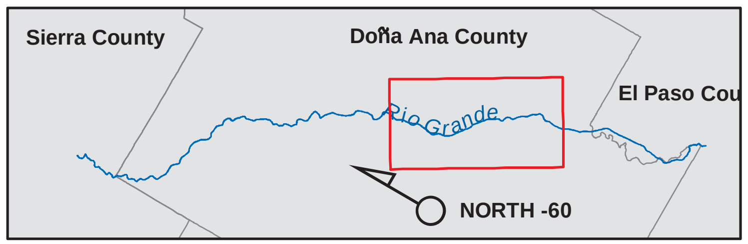

Figure 3-8
Land Use Classification: Miles 25-50

United States Section,
International Boundary Water Commission
December 2003

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NORTH -60

SCALE = 1 : 100,000 or 1 INCH = 8,333 FEET
UTM Zone 13 N / NAD 83

0 2.5 5 10 Kilometers

0 1.5 3 6 Miles

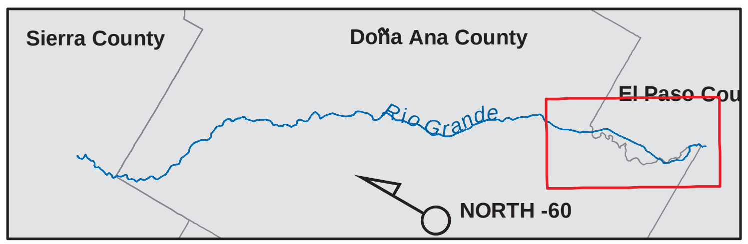

Figure 3-9
Land Use Classification: Miles 0-25

United States Section,
International Boundary Water Commission
December 2003

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Table 3.8-1
Land Use Acreage Within 0.25 Mile Outside and Adjacent to the RGCP Right-of-Way

Land Use	Upper Rincon		Lower Rincon		Seldon Canyon*		Upper Mesilla		Las Cruces		Lower Mesilla		El Paso		Total for RGCP	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
Agriculture																
Farming	2,906	61	3,185	67	219	8	544	17	1,563	45	2,141	37	1,323	24	11,881	39
Livestock	244	5	171	4	1,090	41	511	16	30	1	26	0	539	10	2,611	9
Pecan Orchard	145	3	271	6	5	0	684	21	773	22	2,531	43	118	2	4,527	15
Subtotal Agriculture	3,296	69	3,627	76	1,314	50	1,740	54	2,366	68	4,699	80	1,979	36	19,020	63
Residential																
Low Intensity	181	4	785	17	253	10	388	12	460	13	786	13	603	11	3,457	11
Medium Intensity	0	0	0	0	4	0	57	2	191	5	145	2	638	12	1,035	3
High Intensity	0	0	0	0	0	0	17	1	98	3	27	0	723	13	864	3
Total Residential	181	4	785	17	257	10	462	14	749	21	959	16	1,963	35	5,356	18
Government																
Federal Government	1,277	27	210	4	1,034	39	1,025	32	336	10	21	0	72	1	3,976	13
State Park	23	0	0	0	17	1	14	0	0	0	0	0	0	0	54	0
Total Government	1,299	27	210	4	1,051	40	1,039	32	336	10	21	0	72	1	4,030	13
Institutional	0	0	0	0	0	0	4	0	0	0	112	2	45	1	161	1
Industrial	0	0	24	1	0	0	0	0	0	0	0	0	421	8	446	1
Commercial	2	0	100	2	13	0	7	0	32	1	67	1	1,056	19	1,276	4
Total	**4,778**	**100**	**4,746**	**100**	**2,635**	**100**	**3,251**	**100**	**3,484**	**100**	**5,858**	**100**	**5,537**	**100**	**30,289**	**100**

* There is no USIBWC right-of-way in Seldon Canyon; the land use corridor extends 1/4 mile from each side of the river centerline.

El Paso County River Park. The USIBWC has an existing lease with the County of El Paso for a river park and trail extending from Country Club Bridge to Vinton Bridge on the west floodway. The county is currently developing the approximately 150-acre area. The county plans to extend the park at a latter date from Vinton Bridge to the Texas / New Mexico state line. The extension is planned to be about 75 acres on the east floodway. The county park plans include trails to accommodate pedestrians, bike and horse activities, park benches, green areas, historic interest signs, and small bridges to cross the drains.

City Park of Sunland Park, New Mexico. The 57-acre Sunland Park, New Mexico river park is located upstream from Anapra Bridge within the flood plain on the east side of the river. It includes picnic tables, grills, portable restrooms, and a playground for day use. The cities of El Paso and Sunland Park are proposing to eventually connect their respective river parks to the existing El Paso County river park. Master plans indicate connecting all existing and proposed city parks adjacent to the Rio Grande along the RGCP as well as the Rectification Project.

3.9 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

This section describes the socioeconomic resources and environmental justice issues within the RGCP potential region of influence. The river management alternatives under consideration would affect areas located within Sierra County and Doña Ana County, New Mexico and El Paso County, Texas (potential region of influence). Though countywide data are presented, only the southern most reaches (5-6 miles) of Sierra County and about half of El Paso County lie within the RGCP area.

The socioeconomic activity examined included population, employment, and characteristics of local industries, housing, and community infrastructure. Environmental justice issues are discussed in the final subsection.

3.9.1 Socioeconomic Criteria

Population

Table 3.9-1 presents total population in the potential area of influence, along with population trends from 1980 to 2000, and 20-year projections corresponding to the timeframe adopted for implementation of the river management alternatives.

The total population within the three-county region is estimated at 867,574, approximately 78 percent are located in El Paso County, 20 percent in Doña Ana County, and 2 percent in Sierra County (U.S. Census Bureau 2000). Historical population growth within the region has been accelerated since 1980, with a 48 percent increase by the year 2000. Doña Ana County had the largest population increase, approximately 81 percent, while Sierra County and El Paso County had 57 percent and 42 percent increase, respectively (U.S. Census Bureau 1998).

Table 3.9-1 Population in El Paso, Doña Ana and Sierra Counties

	1980 Total Population[a]	1980-2000 Increase	2000 Total Population[b]	Projected Increase	2020 Total Population Projection
El Paso County	479,899	42%	679,622	36%	926,760[c]
Doña Ana County	96,340	81%	174,682	62%	282,152[d]
Sierra County	8,454	57%	13,270	0.8%	13,380[d]
Combined three- county region	584,693	48%	867,574	41%	1,222,292

a U.S. Bureau of the Census, USA Counties, 1998
b U.S. Bureau of the Census, Census 2000.
c Texas State Data Center, 2001
d University of New Mexico, Bureau of Business and Economic Research, 1997

Projections for the year 2020 give a 1,222,292 population, representing a 41 percent increase from 2000 for the three-county region. El Paso County population is projected to grow approximately 36 percent to 926,760 (Texas State Data Center 2001) while Doña Ana County is expected to have a 62 percent population increase from 2000 (University of New Mexico 1997). Sierra County is projected to grow 0.8 percent for the same period (University of New Mexico 1997).

Employment

In the year 2000, counties within the potential region of influence reported 331,498 total employment, with 79 percent within El Paso County (Texas Workforce Commission 2000), followed by Doña Ana County with 20 percent and Sierra County with approximately 1 percent (New Mexico Department of Labor 2000). Approximately 98 percent of employment within these counties encompasses the non-agricultural sector of the economy, with only about 2 percent employment in agricultural-related services (U.S. Department of Labor 2000).

Between 1980 and 2000, employment within the potential region of influence increased 62.3 percent Doña Ana County experienced the greatest employment increase of 90.6 percent, followed by Sierra County at 87.9 percent and El Paso County at 56.2 percent (U.S. Census Bureau 2000; U.S. Census Bureau 1998). Table 3.9-2 presents 1980 and 2000 employment data and percent changes for the three-county region.

The 2000 unemployment rate in the region was 7.8 percent, a slight decrease from 8.0 percent in 1980 (U.S. Census Bureau 1998). These values are higher than the United States national average (4 percent) and the state average for New Mexico and Texas (4.9 percent and 4.2 percent, respectively). El Paso County had the highest rate of unemployment at 8.2 percent, followed by Doña Ana County at 6.5 percent. Unemployment in Sierra County was lower than the national average, at 2.9 percent (New Mexico Department of Labor, 2000; Texas Workforce Commission 2000). Unemployment rates for each county and the region of impact are presented in Table 3.9-2.

Table 3.9-2 Employment Data for El Paso, Doña Ana and Sierra Counties

		1980 Census[a]	2000 Census[b]	Percent Change
El Paso County	Labor Force	181,867	284,758	56.6%
	Total Employment	167,344	261,318	56.2%
	Unemployment Rates	8.0%	8.2%	---
Doña Ana County	Labor Force	37,816	70,923	87.5%
	Total Employment	34,768	66,278	90.6%
	Unemployment Rates	8.1%	6.5%	---
Sierra County	Labor Force	2,219	4,017	81.0%
	Total Employment	2,077	3,902	87.9%
	Unemployment Rates	6.4%	2.9%	---
Region of Impact	Labor Force	221,902	359,698	62.1%
	Total Employment	204,189	331,498	62.3%
	Unemployment Rates	8.0%	7.8%	---

[a] U.S. Census Bureau, USA Counties Data, 1998
[b] U.S. Census Bureau, Census 2000

A majority of employment within the region lies in the service, trade, and government sectors. Each of these industries individually comprise approximately 24 percent of the non-agriculture employment in the region. In El Paso County, employment is also high in the manufacturing and transportation industries, 5.3 percent and 5.9 percent, respectively (Texas Workforce Commission 2000). Employment is relatively high in the construction industries in Doña Ana County and Sierra County, at 6.1 percent and 6.9 percent, respectively (New Mexico Department of Labor 2000). Table 3.9-3 presents 2000 employment data for the major industries in each county and the combined area.

Table 3.9-3 Major Non- Agricultural Employment Sectors in El Paso, Doña Ana and Sierra Counties

	El Paso County		Doña Ana County		Sierra County		Combined Region	
Employment Sector	Employed	%	Employed	%	Employed	%	Employed	%
Construction	12,597	5.0	3,270	6.1	186	6.9	16,053	5.3
Manufacturing	38,069	15.3	3,219	6.1	43	1.6	41,331	13.5
Transportation	14,812	5.9	2,058	3.9	82	3.0	16,952	5.6
Trade	61,370	24.6	11,847	22.3	710	26.4	73,927	24.2
Finance, Insurance & Real Estate	9,334	3.7	1,860	3.5	106	3.9	11,300	3.7
Services	58,392	23.4	14,870	28.0	637	23.7	73,899	24.2
Federal, State & Local Government	54,888	22.0	16,069	30.2	929	34.5	71,886	23.5
Total[c]	**249,462**		**53,193**		**2,693**		**305,348**	

a Texas Workforce Commission, 2000
b New Mexico Department of Labor, 2000
c Total employment within major industries, not data for total employed labor force

Many colonia residents are employed as migrant or seasonal workers. A seasonal worker is an individual whose principal employment (51 percent or more) occurs on a seasonal basis. The definition of a migrant worker is similar; however, a migrant worker establishes a temporary abode for the purpose of employment (Larson 2000). There are an estimated 2,378 migrant and seasonal farm workers in El Paso County. Of the colonia residents in El Paso County, approximately 30 percent are agricultural workers and approximately 24 percent are construction workers. This type of work is often seasonal, resulting in fluctuating unemployment rates within these communities (Border Low Income Housing Coalition 2001).

Agriculture

Approximately 19,020 acres of private agricultural land lie in the 1/4-mile wide land use corridor on each side of the ROW. Though agriculture is not considered a major industry within the three counties, the majority of land adjacent to the RGCP is used for agriculture. Table 3.9-4 presents agricultural data for the three counties and the potential region of influence. Data were obtained from the U.S. Department of Agriculture (1997) and includes the number of farms, their acreage, number of workers per farm, and estimated market value.

Table 3.9-4 Agricultural Data for El Paso, Doña Ana and Sierra Counties

	Number of Farms	Acres of Farms	Number of Farm Workers	Market Value (in thousands)
El Paso County	415	243,684	1,216	$76,673
Doña Ana County	1,290	581,436	4,330	$235,484
Sierra County	180	1,286,887	453	$15,766
Region of Impact	1,885	2,112,007	5,999	$327,923

Source: U.S. Department of Agriculture, 1997 Census of Agriculture

Total reported acreage for the three-county region for 1997 was 2,122,007, with more than half located in Sierra County (60.8 percent), and 27.5 percent in Doña Ana County. The total estimated market value was approximately $328 million. Doña Ana County had the highest number of farms (1,290), farm workers (4,330) and market value ($235.5 million), followed by El Paso County. The average number of workers per farm for the three-county area was 3.2.

Income

Per Capita Income. The U.S. Census Bureau defines per capita income as the average income computed for every man, woman, and child in a particular group. Per capita income within the potential region of influence is lower than both the national and state averages. In 1999 per capita income among the three counties averaged $17,828, 62 percent of the $28,546 national average. Sierra County had the highest per capita income of $19,265, 67 percent of the national average and 88 percent of New Mexico's $21,836 average. With an average of $17,003, Doña Ana County per capita income stood at 78 percent of New Mexico's average and approximately 60 percent of the national average. Similar to Doña Ana County, El Paso County per capita income averaged $17,216 in 1999, 64 percent of the Texas $26,834 average and 60 percent of the national average (U.S. Department of Commerce 1999).

Median Household Income. This criterion, as defined by the U.S. Census Bureau, is based on individual households, including families and unrelated resident individuals of 15 years or older with an income. The median household income in the region of impact was estimated at $24,323 for 1997. This is approximately 66 percent of the national median household income and approximately 70 percent and 79 percent of the Texas and New Mexico averages, respectively. Doña Ana County led with a median household income of $26,379 followed by El Paso County at $25,866 and Sierra County at $20,724 (U.S. Census Bureau 2000).

Housing

The total number of housing units within the three-county region was reported as 298,384 in 2000 (U.S. Census Bureau 2000). Among the total housing units, 275,691 (approximately 92 percent) were occupied, leaving an 8 percent vacancy rate within the region of impact. Sierra County, with the least population, had the highest vacancy rate of 30 percent. Vacancy rates in Doña Ana County and El Paso County were lower at 8.7 percent and 6.4 percent, respectively (U.S. Census Bureau 2000). Total housing units and vacancy rates for each county and the region of impact are presented in Table 3.9-5.

Table 3.9-5 Housing Data for El Paso, Doña Ana and Sierra Counties

	Total Housing Units	Occupied Housing Units	Percent of Vacant Housing Units
El Paso County	224,447	210,022	6.4%
Doña Ana County	65,210	59,556	8.7%
Sierra County	8,727	6,113	30.0%
Potential region of influence	298,384	275,691	7.6%

Source: U.S. Bureau of the Census, Census 2000.

3.9.2 Environmental Justice

Under Executive Order 12898 (Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations, dated February 11, 1994), federal agencies are required to address disproportionately high and adverse human health and environmental effects on minority and low-income populations. The environmental justice section of this document is reported in compliance with Executive Order 12898.

Relevant demographic data is provided to assess any disproportionately high minority or low income populations within El Paso County, Texas and Doña Ana County, and Sierra County, New Mexico. Because the project area is located in both Texas and New Mexico, demographic data for these two states are combined, and together these states will represent the geographical unit of comparison. Demographic data for El Paso County, Doña Ana County, and Sierra County are compared with the combined data for Texas and New Mexico. For purposes of impact analysis, the combined data for Texas and New Mexico will be referred to as the region of comparison.

Demographic Data

Executive Order 12898 considers a minority as an individual belonging to one of the following population groups: Hispanic, Black (not of Hispanic origin), American Indian or Alaskan Native, or Asian or Pacific Islander. Under this Executive Order, minority populations are to be identified if (i) the minority population within the affected area exceeds 50 percent or (ii) if the minority population age is meaningfully greater than the age in the general population (Executive Order 12898 1994).

El Paso County and Doña Ana County both have a disproportionately high minority population, exceeding 50 percent. Minority populations comprise 83.2 percent in El Paso County and 67.4 percent in Doña Ana County. The minority population in the region of comparison is 79.2 percent.

Sierra County does not have a disproportionately high minority population with a 28.6 percent minority rate. Therefore, it will not be necessary to address any effects on minority populations in Sierra County.

Minority populations of Hispanic nationality dominate in both El Paso and Doña Ana Counties with 78.2 percent and 63.4 percent, respectively. Hispanic populations in Sierra County are lower than the region of comparison. Table 3.9-6 presents 2000 population data by ethnicity for El Paso County, Doña Ana County, Sierra County and the region of comparison.

Table 3.9-6 Minority Populations for El Paso County, Doña Ana County, Sierra County and Poverty Rates

	El Paso County	Doña Ana County	Sierra County	Region of Comparison
White	17.0%	32.5%	70.5%	20.9%
Hispanic	78.2%	63.4%	26.3%	74.4%
Black	3.1%	1.6%	0.5%	2.8%
Asian[a]	1.1%	0.9%	0.3%	1.0%
American Indian[b]	0.8%	1.5%	1.5%	1.0%
Total Minority	83.2%	67.4%	28.6%	79.2%
Poverty Rates[c]	27.8%	26.6%	23.4%	27.5%

Source: U.S. Bureau of the Census, 2000
a Asian includes Pacific Islander and Non-Hawaiian
b American Indian includes Eskimo and Aleut
c Poverty rates from U.S. Bureau of Census 2000, 1997 model-based estimate

Poverty Rates

The U.S. Census Bureau official poverty assessment weighs income before taxes and excludes capital gains and noncash benefits (such as public housing, Medicaid, and food stamps). Poverty rates indicate low-income populations are relatively high within all three counties (U.S. Census Bureau 2000). Such counties along the U.S.-Mexico

Border are often havens for colonias (refer to socioeconomic section), where significant low-income populations reside (Texas Department of Human Resources 1988).

The population percentage living below poverty in all three counties is greater than the 16.9 percent in the region of comparison. El Paso County has a poverty rate of 27.5 percent, followed by Doña Ana County and Sierra County at 26.6 percent and 23.4 percent, respectively (U.S. Census Bureau 2000). El Paso County, Doña Ana County, and Sierra County all have disproportionately high low-income populations in relation to the region of comparison.

3.10 CULTURAL RESOURCES

Cultural resources include three elements: architectural resources, archaeological resources and traditional cultural properties. Cultural resources information was collected through a records search and literature review, field reconnaissance and location verification, and consultations with Native American tribes (EMI 2001). Site files in New Mexico and Texas, resource listings in the National Register of Historic Places (NRHP), and listings in the New Mexico State Register of Cultural Properties (SRCP) and, the Texas State Register were reviewed. A 2-mile wide corridor that extends for 105.6 miles of the Rio Grande from Percha Dam to American Dam (one mile on each side of the river centerline) was defined as the cultural resources study area for the records search. This large area was used to define the regional context of the cultural resources in the area. The Canalization Project right-of-way (ROW), or lands administered by the USIBWC, is a narrow corridor encompassing only those lands between the left and right flood control levees and represents approximately 8 percent of the total cultural resources study area.

3.10.1 Architectural Resources

A field reconnaissance was conducted to note historic structures within the RGCP (EMI 2001). No historic buildings or structures, other than bridges and facilities associated with irrigation facilities, were observed during the field reconnaissance. Two buried canals were revealed during the trenching for the geoarchaeological field work at river mile 91 (site LA 131868) and river mile 94 (LA 131869). Site LA 131869 appears to be a former segment of the Palmer Lateral that was relocated during the canalization work during the 1930s and 1940s. Site LA 131868 is an undetermined cobble-line canal that was dug 27.6 inches into the underlying deposits. It also was probably abandoned and buried during the canalization work during the 1930s and 1940s. Table 3.10-1 lists the architectural resources in the RGCP.

A field reconnaissance was conducted to identify additional historic structures within the RGCP ROW (EMI 2001). No historic buildings or structures, other than bridges and facilities associated with irrigation facilities, were observed during the field reconnaissance.

Table 3.10-1 Known Architectural Resources in the RGCP ROW

Site Number	Period	Date	Site Type	NRHP-Status
LA106782	Historic	A.D. 1908-1995	House, outbuildings, water catchment device, water control device	Undetermined, associated with the Leasburg Diversion Dam, New Mexico State Register
LA120257	Historic	A.D. 1915-1925	Irrigation Ditch	Undetermined
LA131868	Historic	A.D. 1846-1945	Irrigation Ditch	Undetermined
LA131869	Historic	A.D. 1846-1945	Irrigation Ditch, Palmer Lateral	Undetermined

Bridges

The RGCP has at least 26 bridges or vehicular crossings between Percha Dam in the north and the American Dam in the south. Rae *et al.* (1987) identified three bridges in Sierra County and 10 bridges in Doña Ana County as historic resources constructued in the 1930s. Those structures reportedly exhibited characteristic engineering or design qualities of the *New Mexico Historic Bridge Survey*. Several of those bridges have been reconstructed or replaced over the last two decades. Original structures remain at Radium Springs (US 85) and at New Mexico highways 28, 226, 227, and 228 (located at Arrey, Berino, Vado and Shalem, respectively).

Irrigation Structures

The Rio Grande Valley has been modified by Native American and Euro American occupants for the past millennium. Numerous irrigation features have been constructed throughout the valley. Four major irrigation feature types occur and include dams, siphons, flumes, and acequias.

Dams. Three diversion dams are in the RGCP area that serve the USBR Rio Grande Project and are operated and maintained by non-federal irrigation districts. These include the Percha Dam (T16S, R5W, Section 36), the Leasburg Dam (T21S, R1W, Section 10), and the Mesilla Dam (unplatted, at about T24S, R1E, Section 13, UTM coordinates 330591E and 3566876N). These dams have associated siphons and gates that are the origins for numerous acequias. A fourth dam, the American Dam (T29S, R4E, Section 15), is operated and maintained by the USIBWC to regulate United States and Mexican waters and provides the last point of allocated river diversion for the RGCP.

The NRCS has constructed 38 dams near or within the RGCP area. All of the dams, with the exception of the Leasburg Diversion Dam, were constructed primarily for flood control purposes. Five of the dams are in Sierra County and 33 structures are in Doña Ana County. Most structures have been transferred to flood control organizations, the EBID, or local communities. Most of these structures are less than 50 years of age. Two dams constructed by the NRCS are more than 50 years of age: Leasburg Diversion Dam, built in 1907, and Spring Canyon Flood Detention Dam, owned by the Village of Hatch, built in 1940.

The American Diversion Dam and the Leasburg Dam are listed on the New Mexico SRCP. The Percha Diversion Dam is listed on both the New Mexico SRCP and the NRHP.

Siphons. Several siphons—Hatch Siphon, Rincon Siphon, and Garfield Siphon on the Arrey Canal—were constructed in the early 1900s. The USIBWC has designed long-term measures for protection of those siphons.

Flumes. The Picacho Flume is located nine miles south of the Leasburg Diversion Dam and is a steel truss structure carrying water on the Leasburg canal over the Rio Grande. It was constructed prior to 1950.

Acequias. The present study has identified six acequia types in the project area: canals, ditches, drains, spur drains, laterals and spurs. None of the irrigation features occur within the RGCP. These features are within 1 mile on each side of the present Rio Grande channel. Irrigation features include ten canals, one ditch, 30 drains, one spur drain, 66 laterals, and one spur. These features irrigate and drain thousands of acres in the Lower Rio Grande Valley.

3.10.2 Traditional Cultural Properties

Traditional cultural properties are locations that embody beliefs, customs or practices of a living community. Native American resources are sites, areas and material important to Native Americans for religious or heritage reasons. Resources may include prehistoric sites and artifacts, contemporary sacred areas, traditional use areas (e.g., native plant or animal habitat), and sources for materials used in the production of sacred objects or traditional implements.

Fundamental to Native American religions is the belief in the sacred character of physical places such as mountain peaks, springs, rivers, and burials. Deities are often described as inhabiting specific locations and specific geographic areas may be identified as points of tribal origin or as central axes of the physical universe.

Traditional cultural properties or sensitive resources that may occur in the study area include pictographs and burials. One of the four sacred mountains of the Mescalero Apache is located northeast of Las Cruces in the San Augustin Mountains (Carmichael 1994:90) and within view of the Rio Grande River Valley. Correspondence with Native American Tribes has not identified any traditional cultural properties within the RGCP ROW. Letters were sent in December 2000 to the six tribes that may have concerns regarding management changes of the RGCP, and follow-up phone calls were subsequently made. Table 3.10-2 summarizes findings of the consultation.

3.10.3 Archaeological Resources

Archaeological resources consist of both prehistoric and historic sites and may include such site types as lithic and ceramic scatters, pithouses, roomblocks, hearths, trails, foundations, and refuse scatters. The cultural resource records and literature search identified 186 sites (including both archaeological and architectural resources) recorded in the 3.2 km-wide (2 mi) study area: 176 in New Mexico and 10 in Texas (EMI 2001). The records search identified 55 reports pertaining to cultural resource investigations within 1 mile of the Rio Grande channel. An additional 16 reports regarding cultural resources in proximity to the RGCP were also examined.

Table 3.10-2 Summary of Consultation on Traditional Cultural Properties

Native American Tribe	Comments
Pueblo of Isleta in Valencia County, New Mexico	No concerns, but wishes to be informed about project
Mescalero Apache Tribe	Plans to review EIS records prior to commenting
White Mountain Apache Tribe in Whiteriver, Arizona	Indicated that information was under review but no response has been received
Pueblo of Zuni	No response to letter or follow-up call
Ysleta del Sur Pueblo	No response to letter or follow-up call
Fort Sill Apache Tribe in Apache, Oklahoma	No response to letter or follow-up call

Of the 186 sites identified, 130 were prehistoric sites and 56 were historic sites. The 130 prehistoric resources include artifact scatters, hearths, roomblocks, pithouses, depressions, petroglyphs, pictographs, and burials. Fifty-six historic archaeological and architectural resources were recorded and included nine major site types: irrigation facilities, artifact scatters and refuse dumps, structural remains, railroad grades and tracks, trails, forts, a cemetery, a mining facility and an orchard (EMI 2001: 31).

Known Sites

Of the 186 sites, only 19 have been recorded within the RGCP ROW. A field reconnaissance was conducted to verify the locations of these 19 sites locations in reference to the RGCP ROW. The field reconnaissance determined that 9 of the sites are or may be within the ROW and include 7 prehistoric sites and two multicomponent sites (both prehistoric and historic period occupations) (Table 3.10-3). The prehistoric sites date to the Archaic period (5500 B.C.-A.D. 900), the Mogollon Late Pithouse (Jornada) (A.D. 750-1100), and the Mogollon Late Pueblo (Jornada) to Late Pueblo (Jornada) (A.D. 1175-1400). The historic sites include a trail and corral dating post A.D. 1539 and an unknown occupation dating pre A.D. 1880. None of these sites have been formally evaluated for eligibility to the NRHP.

Table 3.10-3 Known Archaeological Resources in the RGCP ROW

Site Number	Period	Date	Site Type	NRHP-Status
LA1646	Prehistoric	A.D. 1175-1400	Artifact Scatter	Undetermined
LA1671	Prehistoric/Historic	A.D. 1175-1400; A.D. 1539-1993	Roomblock; trail, corral	Undetermined
LA2410	Prehistoric	A.D. 750-1100	Artifact scatter	Undetermined
LA2800	Prehistoric	A.D. 750-1100	Artifact scatter	Undetermined
LA2895	Prehistoric	A.D. 1100-1400	Artifact scatter	Undetermined
LA2931	Prehistoric	A.D. 1175-1400	Mound	Undetermined
LA72703	Prehistoric	5500 B.C.-A.D. 900	Pictograph	Undetermined
LA107943	Prehistoric/Historic	Unknown	Artifact scatter	Undetermined
LA131204	Prehistoric	Archaic; Mogollon	Artifact scatter	Undetermined

Undiscovered Sites

Background. There is a potential for undiscovered archaeological sites to occur within the RGCP ROW. Particular landforms appear to have a greater likelihood of containing surface and subsurface cultural deposits (EMI 2001). During the Puebloan period, the reliance on farming probably resulted in decreased use of active floodplain areas for more permanent residence. Repeated floods and continued new channel alignments would be a threat to permanent habitation structures. Under these conditions a minimal archaeological record might be expected, with most land use in the floodplain limited to brief temporary camps associated with agricultural field maintenance or hunting and gathering activities.

Earlier landscapes in the valley floodplain and in the valley margins are preserved in the fluvial deposits not visible on the surface. The shallow floodplain soils bordering nineteenth century river channels have the potential to contain well-preserved archaeological deposits dating to at least 2500 years. Historic use of the area can be found in silted-in river channels that were active during the nineteenth century, and has been demonstrated by the discovery of buried irrigation canals predating canalization work. Examination of the deeper deposits exposed in alluvial fans indicates the presence of buried soil surfaces dating to the mid-Holocene. Older landforms are located along the Rio Grande Valley margins. In the side canyons and areas containing alluvial fans, site density should be higher as a result of the limited space available for occupation.

Potential for Surface Cultural Resources. Areas within the RGCP with a higher potential to contain surface cultural resources are those ground surfaces that are elevated above the floodplain (EMI 2001). These areas are also less likely to have been silted over or scoured away by seasonal flooding. Several qualitative factors also contribute to the selections. Prehistoric peoples permanently occupied areas that were less subject to spring season flood damage. Elevated areas in the Rio Grande Valley were attractive for settlement because they were generally warmer during winter months as a result of climatic inversion and cooler during summer months because of breezes in open areas. There is a tendency for people to occupy such areas since they can provide a good visual overview of the surrounding terrain for observing potential game and personal protection. Since most elevated surfaces within the Rio Grande Valley were formed within the last 4000 years, they are well within the time span of human occupation in the region.

Potential for Subsurface Cultural Deposits. Archaic period, middle- to late-Holocene hunter-gatherer groups occupying point bars or areas near active stream channels probably established limited activity temporary camps. In these floodplain environments, artifact densities can be expected to be small and of low archaeological visibility. As the Rio Grande channel shifted, these briefly occupied areas became buried. New temporary camps would be continually created in response to accompanying the lateral shift in the Rio Grande channel. These temporary camps on the floodplain would be expected to be dispersed. In contrast, camps along the Rio Grande Valley margin were probably more stable and less likely to be eroded and destroyed by lateral channel movement. Canyon outlets or alluvial fan toe slopes would have provided small areas for human occupation. Repeated occupations of these areas would result in greater accumulations of occupation debris that would become buried by hillslope or alluvial fan deposition. Higher site densities and greater artifact concentrations could be anticipated in these settings.

A total of 27 high potential areas were identified in the RGCP ROW that displayed landform characteristics suitable for the preservation of undiscovered surface and subsurface archaeological sites (EMI 2001). Some archaeological sites are likely to occur in these areas and some may be considered NRHP-eligible.

3.10.4 Summary of Findings

Architectural Resources. An evaluation of a 2-mile corridor along the Rio Grande from American Dam to Percha Dam indicated the presence of 13 bridges, 4 dams, 3 siphons and a flume that are older than 50 years. Only the timber trestle bridge near Radium Springs (No. 2591) is listed on the New Mexico SRCP (Rae *et al.* ,1987:56). The American Diversion Dam and the Leasburg Dam are listed on the New Mexico SRCP. The Percha Diversion Dam is listed on both the New Mexico SRCP and the NRHP. The Spring Canyon Flood Detention Dam, owned by the Village of Hatch, is also a historic resource, built in 1940.

Cultural resources recorded in previous field surveys indicated four resources associated with the RGCP ROW: standing buildings and structures associated with the Leasburg diversion dam (outside USIBWC jurisdiction), and three buried canal segments. The location of these sites along the RGCP are listed by river mile in Table 3.10-4.

Traditional Cultural Properties. No traditional cultural properties in the RGCP or viewshed have been identified through correspondence with Native American Tribes.

Archaeological Resources. Of a total of 19 known sites identified in the RGCP, 9 were located within or close to the ROW. The location of these 9 sites along the RGCP is listed by river mile and RMU in Table 3.10-4.

A total of 27 areas with a higher potential for undiscovered archaeological sites were identified along the RGCP (EMI 2001). These locations are listed by river mile and RMU in Table 3.10-4.

Table 3.10-4 Historical and Archaeological Sites, and Areas with a Higher Potential for Preservation of Cultural Resources

River Management Unit	River Mile	Historical Sites from Previous Surveys	Archaeological Sites Along the RGCP	Areas with a Higher Potential for Undiscovered Sites
Upper Rincon RMU	105-90	91, 94	92	91, 94, 96, 97
Lower Rincon RMU	72-90	74	82	73, 74, 80, 83, 84, 85
Seldon Canyon RMU	63-72		66, 67, 68, 71	64, 65, 66, 68
Upper Mesilla RMU	51-63	62	56	52, 54, 57
Las Cruces RMU	40-51			40
Lower Mesilla RMU	21-40			23, 24, 28, 30
El Paso RMU	0-21		5 (2)	5, 7, 14, 15, 16
Total Number		*4 sites*	*9 sites*	*27 locations*

3.11 AIR QUALITY

3.11.1 Air Pollutants and Regulations

Air quality in any given region is measured by the concentration of various pollutants in the atmosphere, typically expressed in units of parts per million (ppm) or in units of micrograms per cubic meter (μg/m3). Air quality is not only determined by the types and quantities of atmospheric pollutants, but also by surface topography, the size of the air basin, and by the prevailing meteorological conditions.

The Clean Air Act Amendments of 1990 (CAAA) directed the USEPA to develop, implement, and enforce strong environmental regulations that would ensure cleaner air for all Americans. The promulgation of the CAAA was driven by the failure of nearly 100 cities to meet the National Ambient Air Quality Standards (NAAQS) for ozone and carbon monoxide and by the inherent limitations in previous regulations to effectively deal with these and other air quality problems.

The USEPA established both primary and secondary NAAQS under the provisions of the CAAA. Primary standards define levels of air quality necessary to protect public health with an adequate margin of safety. Secondary standards define levels of air quality necessary to protect public welfare (i.e., soils, vegetation, and wildlife) from any known or anticipated adverse effects from a criteria air pollutant. The CAAA also set emission limits for certain air pollutants for new or modified major sources based on best demonstrated technologies, and established health-based national emissions standards for hazardous air pollutants.

NAAQS are currently established for six air pollutants (known as “criteria air pollutants”) including carbon monoxide (CO), nitrogen oxides (NOx, measured as nitrogen dioxide, NO_2), ozone (O_3), sulfur oxides (SOx, measured as sulfur dioxide, SO_2), lead (Pb), and particulate matter equal to or less than 10 microns in aerodynamic diameter (PM_{10}). There are many suspended particles in the atmosphere with aerodynamic diameters larger than 10 microns, collectively referred to as total suspended particulates (TSP).

In 1997 USEPA promulgated two new standards: a new 8-hour ozone standard (which could eventually replace the existing 1-hour ozone standard) and a new standard for $PM_{2.5}$, which are fine particulates (with diameters less than 2.5 microns) that have not been previously regulated. In addition, USEPA revised the existing PM_{10} standard. The two new standards were scheduled for implementation over a period of several years, as monitoring data became available to determine the attainment status of areas in the U.S. However, USEPA was challenged in court on these new and revised standards, and in May 1999, the U.S. District of Columbia Court of Appeals issued a ruling stating that the CAA as applied and absent further clarification "effects an unconstitutional delegation of legislative power." Furthermore, the court stated that the new 8-hour ozone standard was remanded back to USEPA for further consideration and "cannot be enforced." It also stated that the new $PM_{2.5}$ standard was allowed to remain in place - but affected parties can apply to have this standard vacated under certain condition - and that the revised PM_{10} standard was vacated and replaced by the pre-existing PM_{10} standard.

The case was appealed to the U.S. Supreme Court, and in February 2001, the court upheld the 8-hour ozone standard and instructed the USEPA to develop a reasonable interpretation of the nonattainment implementation provisions. The Supreme Court has validated the USEPA's standard setting authority and procedures and in March 2002, the remaining challenges to the $PM_{2.5}$ standard were rejected. USEPA is seeking promulgation of the new ozone and PM2.5 standards by December 2004.

The CAAA does not make the NAAQS directly enforceable, but requires each state to promulgate regulatory requirements necessary to implement the NAAQS. The CAAA also allows states to adopt air quality standards that are more stringent than the federal standards. The ambient air quality standards for New Mexico are contained in the Environmental Improvement Act, NMSA 1978, Section 74-1-8(A)(4) and Air Quality Control Act, NMSA. The ambient air quality standards for Texas are contained in the Texas Administrative Code, Title 30, Section 101.21, as amended. Table 3.11-1 contains the national and Texas ambient air quality standards. New Mexico has state standards in addition to the federal NAAQS. Table 3.11-2 lists the New Mexico standards.

Table 3.11-1 National and Texas Ambient Air Quality Standards

Criteria Pollutant	Averaging Time	National and Texas Primary NAAQS[a,b,c]	Secondary NAAQS[d]
Carbon Monoxide	8-hour 1-hour	9 ppm (10,000 μg/m3) 35 ppm (40,000 μg/m3)	No standard No standard
Lead	Quarterly	1.5 μg/m3	1.5 μg/m3
Nitrogen Oxides (measured as NO_2)	Annual	0.053 ppm (100 μg/m3)	0.053 ppm (100 μg/m3)
Ozone[e]	8-hour 1-hour	0.08 ppm (157 μg/m3) 0.12 ppm (235 μg/m3)	0.08 ppm (157 μg/m3) 0.12 ppm (235 μg/m3)
Particulate Matter (measured as PM_{10})	Annual 24-hour	50 μg/m3 150 μg/m3	50 μg/m3 150 μg/m3
Particulate Matter (measured as PM2.5)e	Annual 24-hour	15 μg/m3 65 μg/m3	15 μg/m3 65 μg/m3
Sulfur Oxides (measured as sulfur dioxide)	Annual 24-hour 3-hour	0.03 ppm (80 μg/m3) 0.14 ppm (365 μg/m3) No standard	No standard No standard 0.50 ppm (1,300 μg/m3)

a. National and state standards, other than those based on an annual or quarterly arithmetic mean, are not to be exceeded more than once per year. The ozone standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above the standard is less than or equal to one.

b. The NAAQS and Texas standards are based on standard temperature and pressure of 25 degrees Celsius and 760 millimeters of mercury.

c. National Primary Standards: The levels of air quality necessary to protect the public health with an adequate margin of safety. Each state must attain the primary standards no later than three years after the state implementation plan is approved by the USEPA.

d National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant. Each state must attain the secondary standards within a "reasonable time" after the state implementation plan is approved by the USEPA.

e. The ozone 8-hour standard and $PM_{2.5}$ standards are included for information only. A 1999 federal court ruling blocked implementation of these standards, which the USEPA proposed in 1997. In March 2002 the D.C. Circuit Court rejected the remaining challenges to the 1997 $PM_{2.5}$ standard. USEPA is seeking promulgation of the new ozone and $PM_{2.5}$ standards by December 2004.

Table 3.11-2 New Mexico Ambient Air Quality Standards

Pollutant	Averaging Time	Maximum Concentration
Carbon Monoxide	1-hour 8-hour	13.1 ppm 8.7 ppm
Nitrogen Dioxide	24-hour average Annual average	0.10 ppm 0.05 ppm
Total suspended particles (TSP)	24-hour average 7- day average 30-day average Annual average	150 μg/m3 110 μg/m3 90 μg/m3 60 μg/m3
Sulfur Dioxide	24-hour average Annual average	0.10 ppm 0.02 ppm
Hydrogen Sulfide	1-hour average*	0.01 ppm
Total Reduced Sulfur	½-hour average	0.003 ppm

*Not to be exceeded more than once per year. Source: New Mexico 2002a.

Federal actions must comply with the USEPA Final General Conformity Rule published in 40 CFR 93, subpart B (for federal agencies) and 40 CFR 51, subpart W (for state requirements). The Final Conformity Rule, which took effect on January 31, 1994, requires all Federal agencies to ensure that proposed agency activities conform with an approved or promulgated State or Federal implementation plans. Conformity means compliance with a State or Federal implementation plan for the purpose of attaining or maintaining the NAAQS. Specifically, this means ensuring the Federal activity does not: 1) cause a new violation of the NAAQS; 2) contribute to an increase in the frequency or severity of violations of existing NAAQS; 3) delay the timely attainment of any NAAQS; or 4) delay interim or other milestones contained in the State implementation plan for achieving attainment.

The Final General Conformity Rule only applies to Federal actions in designated nonattainment or maintenance areas, and the rule requires that total direct and indirect emissions of subject criteria pollutants, including ozone precursors, be considered in determining conformity. The rule does not apply to actions that are not considered regionally significant and where the total direct and indirect emissions of nonattainment criteria pollutants do not equal or exceed *de minimis* threshold levels for criteria pollutants established in 40 CFR 93.153(b). The State of New Mexico *de minimis* threshold levels are the same as the Federal standards (New Mexico 2002b). A Federal action would be considered regionally significant when the total emissions from the proposed action equal or exceed 10 percent of the nonattainment or maintenance area's emissions inventory for any criteria air pollutant. If a Federal action meets *de minimis* requirements and is not considered a regionally significant action, then it does not have to go through a full conformity determination. Ongoing activities currently being conducted are exempt from the rule so long as there is no increase in emissions equal to or greater than above the *de minimis* levels as the result of the Federal action. Table 3.11-3 lists the *de minimis* levels for nonattainment areas.

Table 3.11-3 *De minimis* Thresholds in Nonattainment Areas

Criteria Pollutant	Degree of Nonattainment	*De minimis* Level (tons per year)
Ozone (VOC and NO_x)	Serious Severe Extreme Other ozone nonattainment areas outside ozone transport region	50 25 10 100
	Marginal or moderate nonattainment within ozone transport region	50 (VOC) 100 (NO_x)
Carbon Monoxide (CO)	All	100
Particulate Matter (PM_{10})	Moderate Serious	100 70
Sulfur Dioxide	All	100
Lead	All	25

Sources: 40 CFR 93 1999, New Mexico 2002b.

3.11.2 Regional Air Quality

The USEPA classifies the air quality within an air quality control region (AQCR) according to whether or not the concentration of criteria air pollutants in the atmosphere exceeds primary or secondary NAAQS. All areas within each AQCR are assigned a designation of either attainment or nonattainment for each criteria air pollutant. An attainment designation indicates that the air quality within an area is as good or better than the NAAQS. Nonattainment indicates that air quality within a specific geographical area exceeds applicable NAAQS. Unclassifiable and not designated indicates that the air quality cannot be or has not been classified based on available information as meeting or not meeting the NAAQS and is therefore treated as attainment. Before a nonattainment area is eligible for reclassification to attainment status, the state must demonstrate compliance with NAAQS in the nonattainment area for three consecutive years and demonstrate, through extensive dispersion modeling, that attainment status can be maintained in the future even with community growth.

The NMED Air Quality Bureau has regulatory authority for air pollution control in the State of New Mexico, while the TCEQ regulates air pollution in the State of Texas. The El Paso-Las Cruces-Alamogordo Interstate AQCR 153 includes Doña Ana, Lincoln, Sierra, and Otero counties in New Mexico, and Brewster, Culbertson, El Paso, Hudspeth, Jeff Davis, and Presidio counties in Texas. Table 3.11-4 lists the air quality status for the counties in the AQCR.

3.11.3 Baseline Air Emissions

An air emissions inventory is an estimate of total mass emissions of pollutants generated from a source or sources over a period of time, typically a year. Accurate air emissions inventories are needed for estimating the relationship between emissions sources and air quality. The quantities of air pollutants are generally measured in pounds (lbs) per year or tons per year (tpy). All emission sources may be categorized as either mobile or stationary emission sources. Stationary emission sources may include boilers, generators, fueling operations, industrial processes, and burning activities, among others. Mobile emission sources include activity such as on and off highway vehicle operations, waste disposal and recycling, and miscellaneous sources.

Table 3.11-4 Air Quality Status for Counties in Air Quality Control Region 153

Carbon Monoxide (CO)	Nitrogen Oxides (NO_2)	Sulfur Dioxide (SO_x)	Particulate Matter (PM_{10})	Ozone
Part of El Paso County--designated nonattainment, classification—moderate; all other counties unclassifiable or attainment	All counties—cannot be classified or better than national standards	El Paso County—cannot be classified; all other counties—better than national standards	Part of Doña Ana county designated nonattainment, classification, moderate; all other counties unclassifiable	El Paso County designated nonattainment, classification, serious; part of Doña Ana county designated nonattainment, classification, marginal; all other counties unclassifiable or attainment

Sources: 40 CFR 81.332 and 81.344 (Air data updated 9/26/03)

Table 3.11-5 lists the most recent air emissions for Sierra and Doña Ana counties in New Mexico and El Paso County in Texas. Although there are seven other New Mexico and Texas counties within AQCR 153, only the emissions data for Sierra, Doña Ana, and El Paso counties are listed because the activity associated with the alternatives would be localized in the narrow area along the river, and emissions from the activities would not be likely to affect the more distant AQCR counties in New Mexico and Texas.

Table 3.11-5 Baseline Air Emissions for Sierra, Doña Ana, and El Paso Counties

County	Emissions (tons per year, tpy)					
	Carbon Monoxide (CO)	Volatile Organic Carbon (VOC)	Nitrogen Oxides (NO_2)	Sulfur Dioxide (SO_x)	Particulate Matter (PM_{10})	Particulate Matter (PM_{25})
Sierra	16,676	2,085	1,781	83	7,907	1,700
Doña Ana	89,488	11,413	14,158	1,246	63,654	10,997
El Paso	138,253	21,095	24,073	1,986	7,478	3,024
CY99 Totals:	244,417	34,593	40,012	3,315	79,039	15,721

Note: VOC is not a criteria air pollutant. However, VOC is reported because, as an ozone precursor, it is a controlled pollutant. $PM_{2.5}$ data are included for information only.
Source: AIRData 1999. USEPA 2003.

Specific information describing the types of equipment required for a specific task, the hours the equipment is operated, and the operating conditions vary widely. Emissions from the current RGCP operation and maintenance activities were calculated using established estimating methodologies for equipment operation (Means 2002). Combustive emissions from equipment exhausts were estimated by using USEPA approved emissions factors for various equipment types that would be used for the RGCP operation, maintenance, and mowing activity (USEPA 1985). The emissions presented in Table 3.11-6 include the estimated annual emissions from equipment exhaust associated with RGCP operation and maintenance activity.

Table 3.11-6 Estimated Air Emissions from Current RGCP Operation and Maintenance Activity

Emissions (tons per year, tpy)					
Carbon Monoxide (CO)	Volatile Organic Carbon (VOC)	Nitrogen Oxides (NO_2)	Sulfur Dioxide (SO_x)	Particulate Matter (PM_{10})	Particulate Matter (PM_{25})
68	14	170	19	97	0

Note: VOC is not a criteria air pollutant. However, VOC is reported because, as an ozone precursor, it is a controlled pollutant. $PM_{2.5}$ data are included for information only. Data calculated based on current RGCP operation and maintenance activity.

3.12 NOISE

3.12.1 Guidelines

Noise is defined as sound that is undesirable because it interferes with speech and hearing, is intense enough to damage hearing, or is otherwise annoying. Noise levels often change with time. To compare sound levels over different time periods, several descriptors have been developed that take into account this time-varying nature. These descriptors are used to assess and correlate the various effects of noise on humans.

The day-night average sound level (DNL) is a measure of the total community noise environment. DNL is the average A-weighted sound level over a 24-hour period, with a 10 dBA adjustment added to the nighttime levels (between 10:00 p.m. and 7:00 a.m.). This adjustment is an effort to account for increased human sensitivity to nighttime noise events. DNL was endorsed by the USEPA for use by federal agencies. DNL is an accepted unit for quantifying annoyance to humans by general environmental noise, including aircraft noise. The Federal Interagency Committee on Urban Noise developed land use compatibility guidelines for noise (U.S. Department of Transportation 1980). Potential adverse effects of noise include annoyance, speech interference and hearing loss.

Annoyance

Noise annoyance is defined by the USEPA as any negative subjective reaction to noise by an individual or group. Typically 15 to 25 percent of persons exposed on a long-term basis to DNL of 65 to 70 dBA would be expected to be highly annoyed by noise events, and over 50 percent at DNL greater than 80 (NAS 1977).

Speech Interference

In a noisy environment, understanding speech is diminished when speech signals are masked by intruding noises. Based on a variety of studies, DNL 75 dBA indicates there is good probability for frequent speech disruption. This level produces ratings of "barely acceptable" for intelligibility of spoken material. Increasing the level of noise to 80 dB reduces the intelligibility to zero, even if the people speak in loud voices.

Hearing loss

Hearing loss is measured in decibels and refers to a permanent auditory threshold shift of an individual's hearing. The USEPA (USEPA 1974) has recommended a limiting daily equivalent energy value of equivalent sound level of 70 dBA to protect against hearing impairment over a period of 40 years. Hearing loss projections must be considered conservative as the calculations are based on an average daily outdoor exposure of 16 hours.

3.12.2 Baseline Noise Levels

Areas along RGCP sites include two distinctly different settings for noise purposes. One setting is rural and the other setting is urban.

Noise sources in the rural setting include operation of RGCP maintenance equipment, as well as farming and ranching equipment. Additionally there is sporadic vehicular traffic on gravel roads adjacent to the RGCP and on bridges crossing the RGCP. The background noise levels in the rural areas when tractors and equipment are not operating would be approximately DNL 45 dBA based on a typical noise environment in a rural area away from highways (USEPA 1974). The area adjacent to the RGCP is used for ranching and farming. Therefore, residences are scattered and there are no populated centers. Sierra County, New Mexico is predominantly rural and has no urban area and has population density of 3.2 persons per square mile (USBC 2002c). It is estimated that the population density in the rural areas of the RGCP in Doña Ana County, New Mexico and El Paso County, Texas would be the same as Sierra County based on comparison of aerial photographs of the rural areas of all three counties.

The area along the RGCP in Las Cruces, Doña Ana County and El Paso, El Paso County are typical of an urban setting. Noise sources in these areas include vehicle and construction equipment operation as well as numerous other sources. The noise levels in urban areas would be expected to range from about DNL 50 dBA for a quiet daytime setting to approximately DNL 80 dBA for a typical noisier condition. Doña Ana and El Paso counties have both urban and rural areas. Therefore, the Las Cruces and El Paso urban areas influence the overall population density of Doña Ana and El Paso counties, which are 45.9 and 670.9 persons per square mile, respectively (USBC 2002a, USBC 2002b). Since these population densities include both the rural and urban areas of the counties, the population density in the areas adjacent to the RGCP in the Las Cruces and El Paso areas likely would be greater than the overall county density.

3.13 TRANSPORTATION

Local, state, and interstate roadways are located throughout the project area. Many of these roadways run parallel and or adjacent to the Rio Grande. The roadways within the project area that could compromise routes to and from the levees during project construction are discussed in this section.

The transportation system for the three county area is served by a network of federal and state highways which includes Interstates 10 and 25. U.S. Highway 85 generally parallels the Rio Grande from Las Cruces to Hatch and U.S. Highways 20 and 478 run just east of the river and connects El Paso to Las Cruces. U.S. Highway 20 changes to U.S. Highway 478 near Anthony, Texas and then connects to U.S. Highway 85 in Las Cruces. The project site is also well served by numerous other state and farm to market (FM) highways throughout the valley.

There are 26 bridges that cross the Rio Grande from the American Dam to the Percha Dam. Approximately 70 percent of them are located in the Mesilla Valley area and the remaining 30 percent are located in the Rincon Valley. These bridges provide good access across the entire project area and to access roads that lead to property owners adjacent to the Rio Grande.

Approximately 85 percent of the Rio Grande between El Paso and the Percha Dam is considered to be in rural areas and the remaining 15 percent is considered urban. The urban areas are near Las Cruces and El Paso. The roadways that run parallel, across, or adjacent to the levees of the Rio Grande are described below.

Approximately 8 miles of the Rio Grande is located in Sierra County, which is considered entirely rural. The Rio Grande flows along urban areas adjacent to the western portion of El Paso County for approximately 20 miles. However, the majority of the project area, 78 miles, is located in Doña Ana County, which is mostly rural except for an approximate 2-mile area near the western portion of Las Cruces.

Interstate 10 (I-10) and I-25 are the main throughways in the project area, traveled by visitors to the area as well as by those who reside in the three counties. The western boundary of Las Cruces extends to the Las Cruces Regional Airport along I-10. The northern border of the city extends north of the U.S. Highway 70 and I-25 interchange and the southern border from the I-10 and I-25 interchange. The Rio Grande runs northwest to southeast along the western edge of the city and parallel to State Highways 28, 185 and 292. Numerous feeder roads connect to these highways and service the areas parallel to the Rio Grande.

Interstate 10 runs south and parallel to the Rio Grande from Las Cruces to El Paso, Texas. Along the western portion of El Paso, State Highway 20 runs parallel to the river and then connects to I-10 and US Highway 85. Similar to Las Cruces, El Paso has numerous feeder roads that cross over or run parallel to the levees along the river.

State Highway 185 runs parallel to the Rio Grande from Las Cruces to Hatch where the highway changes to State Highway 187 at the junction of State Highways 26, 154, and 185 near mile marker 84. State Highway 187 continues along the Rio Grande to mile marker 100 where it crosses the river.

Table 3.13-1 lists the roadways expected to be accessed during construction and maintenance activities on the project along the Rio Grande from the American Dam to the Percha Dam. The 1997 average daily traffic volumes on those roadways, roadway characteristics, and associated level of service (LOS) are also included in the table (CH2M-Hill 2000b).

Driver satisfaction can be measured quantitatively during different levels of traffic congestion. This classification, LOS, measures the congestion on a roadway on a continuum from LOS “A” (free flow) to LOS “F” (traffic jam) conditions. For the areas along the Rio Grande from El Paso to the Percha Dam, LOS “A”, “B”, and “C” are considered to be acceptable roadway operating conditions in urban areas. LOS “D” is considered marginally acceptable; LOS “E” is undesirable; and LOS “F” is considered to be unacceptable congestion levels.

The LOS standard for Texas is C while the LOS for New Mexico is B. The New Mexico Department of Transportation allows lowering the existing LOS of a particular roadway one level during construction of roadway projects, but requires maintaining at least a LOS of D at all times (CH2M-Hill 2000b).

Table 3.13-1 Roadway Characteristics, Average Daily Traffic and Existing Level of Service

Roadway	Proximity to the Rio Grande	Characteristics	Average Daily Traffic (ADT)	Average Daily Truck Traffic	Existing Level of Service (LOS)
SH 62/180	South of American Dam	4 lanes, paved, 40 mph	53,062	5,306	D
I 10	Parallels river	4 lanes interstate, paved, 65 mph	40,000	4,000	C
SH 375	Mile 12	4 lanes, paved, 60 mph	40,000	4,000	C
SH 20	Mile 16.5	4 lanes, paved, 60 mph	9,220	922	A
SH 478	Parallels river	2 lanes, paved, 55 mph	12,151	1,215	B
Vinton Rd.	Mile 15.75	2 lanes, paved, 40 mph	5,500	550	A
SH 225	Mile 19.5	2 lanes, paved, 40 mph	4,359	436	A
Levee Road	Parallels river	< 2 lanes, gravel	Data not available	Data not available	Data not available
SH 404	Mile 21	2 lanes, paved, 55 mph	5,496	550	A
SH 226	Mile 24	2 lanes, paved, 55 mph	3,749	375	A
SH 227	Mile 28	2 lanes, paved, 50 mph	2,000	200	A
SH 28	Parallels river	2 lanes, paved, 40 mph	3,586	359	A
SH 192	Mile 32.5	2 lanes, paved, 40 mph	4,518	452	A
SH 228	Mile 32.5	2 lanes, paved, 40 mph	3,110	311	A
I 25	Near Mesilla parallels river	4 lanes interstate, paved, 75 mph	18,379	1,838	B
SH 185	Parallels river starting at mile 45	2 lanes, paved, 55 mph	18,313	1,831	B
SH 154	Mile 82 near Hatch	2 lanes, paved, 40 mph	1,497	150	A
SH 26	Mile 84.5, Franklin Street in Hatch	2 lanes, paved, 30 mph	5,478	548	A
SH 187	Mile 85, Hall Street parallels river	2 lanes, paved, 40 mph	16,307	1,631	D